PUBLIC WORKS

OCTOBER, 1927

CAME TO AMERICA ALONE IN 1905
Now Has Thousands of Descendants

BANTAM CHAMP WINS PRAISE

Austin Pup Acclaimed as Road-maker's Handiest Tool

Despite his diminutive size, he has proved himself capable of the heavier work to which he has been assigned. Letters have come in citing him as the handiest piece of machinery in the whole roadmaker's outfit.

Daily His Popularity Is Growing

The camera caught several photos of this much talked of roller which show him doing various kinds of work, capably, easily and efficiently.

Strength

Here in the first photo he is shown scarifying a rut filled road, breaking up the defective surface so it will be in a condition for building up an even crown.

Perfect Adaptability

In this operation, the Austin Pup not only grades but rolls, leaving behind a finished road ready for high speed motor travel.

Simplicity of Operation

Here is the Austin Pup doing inside work. Dodging between the pillars, getting into the corners, doing the work his heavier brothers couldnot possibly do, and rolling outwhen his jobs were all done then easily transported back to the shops. This is all done with an amazing ease made possible by the simplicity of operation.

WHEN CANNONS ROARED

Hidden somewhere behind this array of dashing mustachios is one of the Austin family doing his bit on the front. During the Great War, over one thousand Austin Rollers represented the Allies in the war zone.

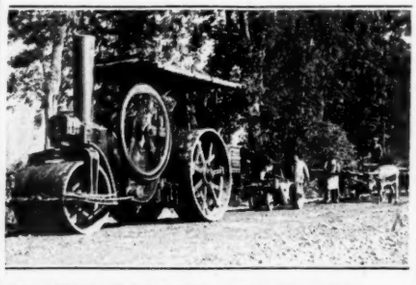
HOW MANY ROADBUILDERS HAVE THOUGHT OF THIS?

A young road contractor named Bender
In a traffic jam once lost a fender
"This jam is too bad"
Said Bender so sad,
"But I guess that my Austin will end 'er"

SINGAPORE WELCOMES AUSTIN ROLLERS

Assured of Level Roads

SINGAPORE, Malay Federated States, July 4—Austin Roller with seven of his kind having traveled from Chicago, was greeted here by many outstanding personages. Those who made his acquaintance felt certain that rattling good cars would soon be traveling their roads, for level well-made roads are an Austin Roller specialty.



AUSTIN ROLLER OPERATING IN THE ANDES OF CHILE

The modern equipment is in striking contrast to the ancient ox drawn carts of the natives.

AUSTIN GIVES U. S. FIRST MOTOR ROLLER

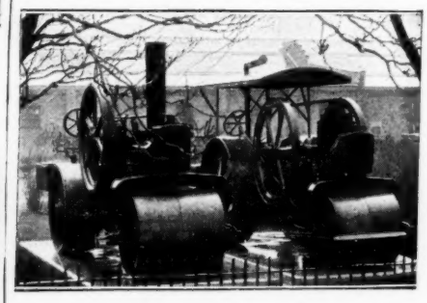
From Belfast, Ireland, Came the Forerunner of a Mighty Host

In the Spring of 1905 the Austin Manufacturing Co., imported this roller for experimental purposes, and so fully were they sold on the practicability of motor rollers that the experiments were continued until, finally in late 1907, they produced a motor roller free from the "bugs" which had held motor rollers back for so long. This was the

First Motor Roller Made in the U. S. A.

Years later, we bought back this roller and fittingly placed it on a pedestal beside the original importation which was the first motor roller in America.

"The Daddy of Them All"



From Whom They Inherited

Strength
Ease of Operation
Simplicity of Operation
Perfect Adaptability

VOL. 58 No. 10

Entered as second-class matter at the Post Office, at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879.
Published monthly by PUBLIC WORKS JOURNAL CORPORATION, 243 West 39th Street, New York, N. Y.
Subscription price $3.00 a year, single copies 35 cents
OCTOBER, 1927

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 58 October, 1927 No. 10

Infiltration Into Sewers

Perfection has not been attained in sewer construction. Even when new, a sewer laid in wet soil may allow the entrance of large quantities of water, and in some cases this flow has been known to take up the entire capacity of the sewer. Fortunately, such occurrences are rare; but even in well-laid lines, the amount of infiltration may necessitate the expenditure of a large amount of money for additional disposal facilities; and where pumping is necessary the additional volume lays an annual extra burden on the taxpayer.

When combined sewers discharging into the nearest stream was the common practice, the amount of flow was of little importance; but with the increasing tendency toward the general treatment of sewage, much study has been given to the devising of methods for the reduction of infiltration. Below are given reports from a large number of engineers from all parts of the country describing their experiences and observations on this subject.

That infiltration is an important matter to the engineer engaged in sewerage works and to municipalities having sewers is proved by the fact that over half of the cities replying to this question in the sewerage questionnaire recently sent out by *Public Works* reported considerable infiltration. The amount of infiltration reported ranged from flows sufficient to take up the entire capacity of the sewer, to unimportant wet weather increases. Of the cities reporting, 124 stated there was an appreciable amount of infiltration, 26 reported "some," and 22 "very little." No appreciable leakage was reported by 115 cities, while 16 reported that they had no information on the subject.

Various causes were assigned as being responsible, chief among which were poor joints, reported by 153 cities. Other causes were cracked or broken pipe, by 19 cities; broken joints, by 3 cities; and leaky manholes or manhole covers by 14. Other causes assigned are overflows from cisterns, seepage through sewer walls, and cracks due to subsidence caused by mine workings.

The leakage into house connections, which are laid under municipal inspection in about three-fourths of the cities, is not considered very important by the majority of those reporting, only 15 giving weight to this source.

Since poor joints are considered the principal cause of infiltration, the type of joint material used is of interest. Cement joints were reported as used by 204 cities, and other types by 123. The majority of the "other types" were asphalt or bituminous, and included G. K., Petrolastic, Jointite, Presstite, Elastite, Filtite, Sewer Seal, Servicised, and Ruberoid. Leadite, lead, clay, and sand and sulphur were reported also. The lead was probably mainly used on soil pipe connections or cast-iron pipe where used to meet special conditions. There appears to be an increasing trend toward the use of asphaltic or bituminous joint materials, or of devices for bettering the usual type of cement joint. Several cities reported using the Weston gasket with cement joints.

Below are given the statements of a number of cities regarding their experiences with infiltration, and means employed in effort to eliminate it:

Florence, Alabama. The maximum leakage observed is such as to fill the sewer half full. This is due principally to poor joints. W. M. Paxton, City Engineer.

Tucson, Arizona. There is no trouble from infiltration because the city is located on a mesa, and the ground water is 100 feet below the surface. George T. Grove, City Engineer.

Glendale, California. The leakage, the amount of which has not been determined, is due to poor joints caused by pipe being laid in wet trench. The remedies adopted are the use of plastic asphalt joints, and of the Weston gasket, and greater care in pumping the trenches dry. J. F. Johansen, City Engineer.

Long Beach, California. Careful observations have been made at three of the pumping stations constructed recently in Long Beach, showing results as follows:

Name of Station	Size of Pipe, Inches	Miles of Pipe in District	Miles of Pipe Below Ground Water	Infiltration Gals. per Day	Gals. per Mile of Submerged Pipe per Day
Naples	8-10	5.67	2.73	71,670	26,200
No. 6	8-18	12.41	3.38	22 050	7,450
No. 6	8-24	13.60	1.71	9,410	5,490

These observations were made before house connections were joined to the system. It is the practice in Long Beach to construct chimneys to a point above ground water level, so far as practicable, for all house connections to submerged lines. The chimneys are constructed at the time the main line is installed, and therefore the house connections should contribute very little added ground water.

The rate of infiltration was determined by observing the rates of inflow into the sumps of the respective pumping stations, the figures given being the average of several observations.

In recent construction, considerable care has been taken to produce a tight line, especially where the ground is wet. All joints were made with cement mortar. For pipe 15 inches and less in diameter, Weston's gaskets and forms were used for making joints. Ground water was not allowed to rise around the joint or flow through the pipe until the joint had set. Joints of pipes larger than 15 inches in diameter were made of cement mortar in the usual manner. L. G. Williams, Assistant Sanitary Engineer.

Richmond, California. There is considerable infiltration, most of which comes from abandoned house connections, or those not yet used. E. A. Hoffman, City Engineer.

San Luis Obispo, California. A leakage of 30,000 gallons per mile of line is reported, most of which enters through manholes in ungraded streets. Streets have been graded and all roof drains eliminated. Warren B. Burch, Consulting Engineer.

San Mateo, California. On all new work, very strict inspection of joint work is maintained. W. D. Soule, Ass't. City Engineer.

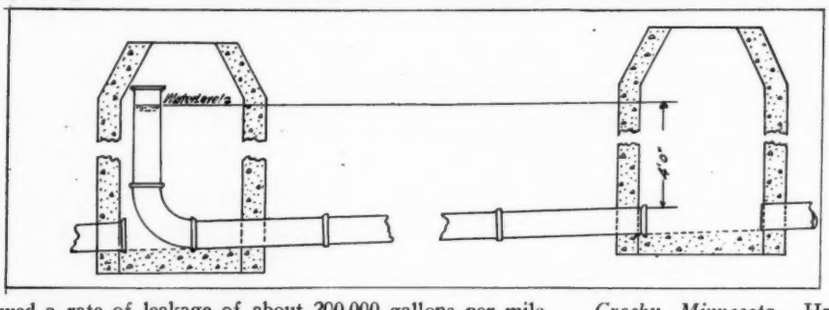
Santa Cruz, California. The leakage by actual field test amounts to 4 gallons per inch of inside diameter per 100 feet for 24 hours, the sewers being below the water table. R. Fowler, City Engineer.

Denver, Colorado. Infiltration is principally through joints. Concrete collars around joints have been tried; also partially encasing sewer in concrete, which is very successful, but expensive. C. A. Davis, Sewer Engineer.

Monte Vista, Colorado. The principal trouble is from the underground water, which in the summer time when irrigation is in operation, rises to a point within less than 18 inches of the ground surface. The sewers, main line and laterals, are discharging at present nearly 10 second-feet of water and sewage and have a length of only 8 miles. About 80 per cent. of this amount is seepage from the underflow, and through well constructed cement joints of 1:2:3 mix. Present plans call for a drainage system to bring the ground water below the sewer grade. W. W. Reilly, City Engineer.

New Haven, Connecticut. A report of Fuller & McClintock states that the average infiltration is 18,000 gallons per mile, most of which is due to joints, cracks, and house connection hubs. C. W. Merrels, Ass't. Engineer.

Miami, Floradia. There is a large amount of infiltration in the old sewers, but no estimate on the whole system has been made. The amount of leakage is estimated by chemical analysis of ground water and sewage, and by checking the estimated flow of sewage against the pumpage. On new sewers, contractors are held to a maximum infiltration of 10,000 gallons per mile of sewer per 24 hours. This is determined before backfilling, being based on the rate of lowering of water in a vertical pipe, as shown in the accompanying sketch. The first test under this method showed a rate of leakage of about 200,000 gallons per mile per day. Investigation disclosed that some stoppers had been omitted from wyes. New contractors nearly always experience difficulty in meeting this test, but local contractors have had no difficulty in building sewers that show as low a rate of leakage as 6,000 gallons per mile per day.



METHOD OF TESTING TIGHTNESS OF JOINTS

A line of pipe between manholes is plugged at the upper manhole, a riser added at the lower and filled with water. The rate of fall of water level gives the rate of leakage through the joints.

A rectangular piece of canvas, held in place by wires from the corners of the canvas, the wires being twisted across the top of the pipe barrel, is used as a form for the grout joint. The canvas is long enough to extend around the lower half of the pipe and wide enough to allow the pouring of cement mortar in one side of the form until mortar appears on the other side. This has proved to be a very satisfactory method of making tight joints, even when the sewer is partially submerged. J. E. Jewett, Office Engineer.

Ocala, Florida. Tests of the amount of infiltration are now in progress. Edward Drake. City Manager.

St. Petersburg, Florida. The leakage, as determined by measurements with a Venturi meter, is 13,000 gallons per mile per 24 hours. E. Kitchen, Director of Public Works.

Kewanee, Illinois. The average leakage per day per mile of line, as determined by night gaugings, is 10,000 to 15,000 gallons. J. G. Palmer, City Engineer.

Madison, Illinois. The amount of infiltration is not known, but is considerable. New specifications call for better joints, and tests for leakage before acceptance. Sheppard and Morgan, Engineers.

Princeton, Illinois. The principal trouble is the roots of elm and soft maple trees entering through poorly cemented joints, and stopping up the sewers. Also a great deal of surface water from the streets and from buildings enter direct into the sewers, carrying some oil, which interferes with the action of the septic tanks. H. L. Parker.

Elwood, Indiana. Nothing is being done on old lines. Rigid inspection and supervision of cement joints on all new construction. John D. Seright, City Engineer.

Huntington, Indiana. More care in cementing joints. J. B. Vernon, City Engineer.

Peru, Indiana. Very particular about cement of joints. Lewis E. Roberts, City Engineer.

Charles City, Iowa. Next year specifications will call for bituminous joints, as concrete is not satisfactory where there are many trees. J. S. Dawson, Engineer.

Newton, Kansas. A leakage survey is now being made. M. Rosebury, City Manager.

Augusta, Maine. There is a great deal of infiltration into one line laid alongside of and below a brook. But in the seven years since it was laid, the infiltration has been growing less. Henry F. Hill, City Engineer.

Baltimore, Maryland. Good joints are required, and there is rigid inspection. Bitumen and salted clay are used for joints. M. J. Ruark, Sewerage Engineer.

Adams, Massachusetts. No appreciable infiltration. Use Weston Gasket. Henry C. Neff, Consulting Engineer.

Brookline, Massachusetts. Asphalt joints have proved very satisfactory. H. A. Varney.

Webster, Massachusetts. Have used G. K. compound with good success. B. A. Wakefield, Town Engineer.

Detroit, Michigan. Infiltration into sewers, which are combined type, is 1,000 gallons per acre per day, most of which enters through joints of laterals. R. R. Ream, Engineer of Sewer Design.

Flint, Michigan. Average leakage, as determined by gagings, is 800 to 1,800 gallons per day. The use of preformed and asphaltic jointing materials has proven successful. H. C. McClure, City Engineer.

Kalamazoo, Michigan. All sewers are underdrained and ground kept dry before sewer is laid. There is no appreciable infiltration. E. C. Clark, City Engineer.

Crosby, Minnesota. Have taken no steps to obtain accurate data on infiltration or leakage. Do know that one of the sanitary sewer laterals carries big excess of water due to infiltration in swampy ground, and from basement floor drain in house near lake with foundation walls below lake level. Holman I. Pearl, Engineer.

Fairmont, Minnesota. There is appreciable infiltration after heavy storms. Joints are not tight enough to exclude all water. Old underdrains back up into manholes. Inadequate storm sewers cause streets to flood and water enter sanitary sewer through manhole covers, considering using different joint in the future. Thos. H. Curtis, Civil Engineer.

Faribault, Minnesota. Not a great deal of infiltration. Cement joints not satisfactory, not so much on account of infiltration as because of permitting roots to enter pipes, which causes a great deal of trouble. A. W. Bedell, City Engineer.

Minneapolis, Minnesota. Leakage of .002 cu. ft. per second per acre is provided for. Joints are made with oakum soaked in grout, and cement mortar is used liberally and placed carefully. C. Illstrup, Sewer Engineer.

Excelsior Springs, Missouri. Mastic joints required on all new construction. J. E. Rider, Consulting Engineer.

Kansas City, Missouri. Combined system. Contractors object to using asphaltic joints and there is a question as

to whether the extra expense is justified on a combined system. O. M. Nichols, Ass't. Sewer Engineer.

Billings, Montana. City is nearly surrounded by irrigated land, and ground water in sewer system is about 1,500 gallons per acre per day for area covered by sewer system. This was determined by measurement of flow and allowance for water consumption. E. M. Sneckenberger, City Engineer.

Havre, Montana. Using richer mortar and better workmanship. E. Sandquist, City Engineer.

Havelock, Nebraska. Exercise more care in laying pipe. O. W. Barnes, City Engineer.

Omaha, Nebraska. Insist on watertight oakum and cement joints. Herman Beal, City Engineer.

Belleville, New Jersey. Use great care in inspection of all joints. Albert S. Blank, Engineer.

East Orange, New Jersey. Infiltration of about 27,000 gallons per mile of sewer per day, through bad joints, cracks, and other unusual conditions. Also have a considerable number of unauthorized connections made by owners to get rid of cellar and ground water. These contribute a heavy flow during wet weather, sometimes double our maximum normal flow. W. D. Willigerod, City Engineer.

New Brunswick, New Jersey. Some leakage in old private sewers. Composition joints are used where tree root trouble is anticipated. Asher Atkinson, City Engineer.

Rutherford, New Jersey. Estimates and measurements place the infiltration at 10,000 gallons per mile per day, most of which is due to poor joints, and much of which comes from house connections. To remedy this, the city is trying to educate inspectors. Engineers in charge should be allowed to select proper inspectors. Robert M. Watson, Consulting Engineer.

Trenton, New Jersey. Planning replacement of old brick sewers, which are factors in the amount of infiltration.

Auburn, New York. More attention to joints has effected an improvement. J. J. Tehan, City Engineer.

East Aurora, New York. Infiltration of about 2,000 gallons daily per mile. Much of the sewer is laid in quicksand. V. S. Hammerstein, Engineer.

Gloversville, New York. Bituminous joints are being substituted for cement mortar joints in all new construction, and excess holes in manhole lids plugged. H. J. Hanmer, City Engineer.

Boro of Queens, New York, N. Y. Infiltration is not measured. Most of it is through poor joints in house connections. Are introducing compound joints. J. V. Perrine, Engineer of Sewers.

Oneonta, New York. Leakage is principally through old cement joints. There is no leakage from lines laid with asphalt joints. F. M. Gurney, City Engineer.

Goldsboro, North Carolina. The infiltration takes one-third the capacity of the sewer. The principal source of leakage is poor joints. All new work is laid with asphalt joints. G. E. Whitman, City Engineer.

Carrington, North Dakota. The leakage is mostly through poorly constructed floors of manholes. G. W. Heinmiller, City Engineer.

Akron, Ohio. Infiltration estimated at 1,000 gallons per day per mile, most of which enters through poor joints and manholes. E. J. Root, Sewerage Engineer.

Columbus, Ohio. The city is making more rigid inspection of bricklaying in manholes and in plastering the outside of manholes, since much of the leakage comes from this source. Poured or Presstite joints are used on all sanitary sewers. O. Bonney, Engineer in charge of Sewerage Relief.

Delaware, Ohio. There is some infiltration from poor joints, but more trouble from downspouts and cistern overflows, which will be checked next year. Geo. S. Irwin, City Engineer.

East Cleveland, Ohio. No data available on the amount of infiltration, which comes chiefly from poor joints, particularly where sewers were laid through quicksand. Rigid inspection is maintained, and particular attention paid to bedding the pipe and mortaring the joints. In 95 per cent. of the cases, rigid inspection with present construction methods gives good results. G. T. Apthorp, Ass't. Engineer.

Lakewood, Ohio. Water consumption is 90 gallons per capita; sewage flow 135 gallons. The increase is attributed to poor joints in old sewers and to roof connections. E. A. Fisher, City Engineer.

Massillon, Ohio. Are very careful about measuring leakage and holding contractor to specifications. Do not allow over 25,000 gallons per day per mile. Using Presstite joints. C. E. Rise, City Engineer.

Oberlin, Ohio. Much trouble from illegal drain and downspout connections. D. F. Herrick, City Manager.

Salem, Ohio. Average infiltration is 12,000 gallons per mile per day, as checked by pumpage and sewage flow. Steps are now being taken to study this question. New type of joint in future. F. S. Barchhoff, City Engineer.

Shelby, Ohio. Survey of sewerage conditions now under way. About 6 per cent. of the flow appears to be infiltration. Boyd W. Weirman, City Engineer.

Zanesville, Ohio. For the past several years Zanesville has been using compound joints, which were very successful in general, but in exceptionally wet trenches some very poor joints were made, as we afterwards found out. On one sewer job of about 1,400 ft. of main sewer and 600 feet of house connections, we used a premolded joint. This sewer was in moderately wet ground, and, to date, the infiltration has been negligible. C. R. Spencer, City Engineer.

Tulsa, Oklahoma. See article, "Asphalt Joints in Sewers."

La Grande, Oregon. After the sewer has been laid 8 days, the line is plugged at the lower end, and tested with not less than 4 feet of water in the sewer. Leaks must be repaired. A. H. McLain, City Engineer.

Portland, Oregon. There has been no appreciable leakage, careful laying of pipe with cement joints being satisfactory. O. Laurgaard, City Engineer.

Altoona, Pennsylvania. Constructed 2 miles of 12-inch, and 0.8 mile 8-inch sewer, part of it through ground saturated with water, and crossed under creek five times, with total infiltration of only 6,000 gallons in 24 hours. Use G. K., Jointite and Filtite joints. H. J. Baum, City Engineer.

Freeland, Pennsylvania. By rigid inspection by competent men, and strict compliance with specifications, satisfactory results have been secured, and there is no appreciable infiltration. Theo. Reichmann, Boro Engineer.

Monessen, Pennsylvania. There is very little infiltration; most of the sewers are on grades of 9 per cent. to 17 per cent. The roots of trees are removed in the vicinity of sanitary sewers. In my opinion, these roots are a contributing cause of leaky joints. Thomas Finnie, City Engineer.

Pawtucket, Rhode Island. This city wherever possible constructs underdrains and gives these an independent outlet at a lower grade. George H. Carpenter, City Engineer.

Charleston, South Carolina. Upon completion of a section of our sewer system about ten years ago, before houses were connected, eight observations were made by pumping out the collecting pit and noting the inflow. After a very wet spell of weather, the inflow was 46,383 gallons per mile per day, which gradually reduced until it reached 18 189 gallons per mile per day. Storm water drains paralleling the sewer and directly connected with the river no doubt affect these figures. The drains, built many years ago, are leaky and are filled with sea water at each high tide. J. H. Dingle, City Engineer.

Aberdeen, South Dakota. Up to 10 or 15 years ago, house connections were not laid with tight joints. These cause most of the leakage. A. E. Bennett, City Engineer.

Rapid City, South Dakota. There is slight leakage. Servicised joints are now being tried; relaying pipe with joints properly cemented. J. P. Soderstrum, City Manager.

Jacksonville, Texas. About 50 per cent of the flow is due to infiltration, according to measurements taken in both wet and dry weather. "Jointite" is used in all wet ground. H. L. Thackwell, Consulting Engineer.

Salt Lake City, Utah. As a result of measurements in one comparatively wet district, it was found that the infiltration in this section was .061 second feet per mile per day, before house connections were made. This infiltration was principally through the cemented joints. For two years, Petrolastic has been used principally for joints, and has been successful. H. C. Jessen, City Engineer.

Salem, Virginia . More care in making joints has lessened infiltration. Cement joints are used. W. Lawrence, Town Manager.

Seattle, Washington. The infiltration, which is caused by seepage through sewer walls, poor joints, and cracks, amounts to one gallon per minute per acre drained. W. C. Morse, City Engineer.

Yakima, Washington. Adoption of poured "Jointite"

joints has materially lessened infiltration on new sewers. C. F. Wilson, City Engineer.

La Crosse, Wisconsin. La Crosse has many shade trees planted in the street between sidewalk and curb. These trees are from 30 to 40 years old and have extensive roots. These roots go through asphalt joints and then broom up and stop the sewer. We have trouble with cement joints, also, when the cement is not properly applied. John H. Barth, Ass't. City Engineer.

Kitchener, Ontario. Infiltration as determined by estimation on completion of work on two lines was 10,000 gallons per mile per day; infiltration is not considered serious enough to warrant action. S. Shupe, City Engineer.

Sault Ste. Marie, Ontario. Now putting in sewers by day labor under our direct supervision, instead of by contract, and are getting better results. A. H. Russell, City Engineer.

Toronto, Ontario. Separate sewers are used only in the lower section of the city, and all are laid in water-bearing ground. The pipe joints are cemented and covered with canvas and the whole sewer surrounded by concrete. This method is effectual for eliminating infiltration. R. C. Harris, Commissioner of Works.

Valleyfield, Quebec. Particular care is employed in making the joints, and the pipes are thoroughly and carefully placed. Raphael Belanger, City Engineer.

Aeration of Water and Sewage

Considerable oxygen absorbed from air bubbling through sewage in activated sludge tanks, as well as by surface aeration

There has been a tendency, especially in England, to advocate the substitution of mechanical agitation for agitation by air in the operation of activated sludge plants. It is claimed by some that the absorption of oxygen which takes place in such tanks is due largely if not exclusively to absorption from the atmosphere at the surface, and little if at all to oxygen derived from the bubbles of air as they pass up through the sewage; with the explanation that the absorption of oxygen is a matter of time as well as of contact and that the time occupied by a bubble in passing through the water is not sufficiently great to cause it to give up any of its oxygen to the water. Another explanation is that each bubble is surrounded by a film of water which accompanies the bubble in its passage to the surface and that no oxygen is given up by the bubble of air except a minute amount which may be absorbed by this film of water. Such absorption as is produced by the bubbles is claimed by some to be due to agitation caused by them as they emerge at the surface and burst with an accompanying spraying of the surface water.

An argument against this idea was published recently in England by Gilbert J. Fowler and S. N. Chatterjee, these engineers taking as their text a statement from a recent book on "Sewage Works," as follows: "The air acts as a mechanical agitator, and is supposed to be absorbed by the sewage as it passes up through it, though it is probable that only a very minute quantity is so absorbed, the bulk of the aeration taking place on the surface."

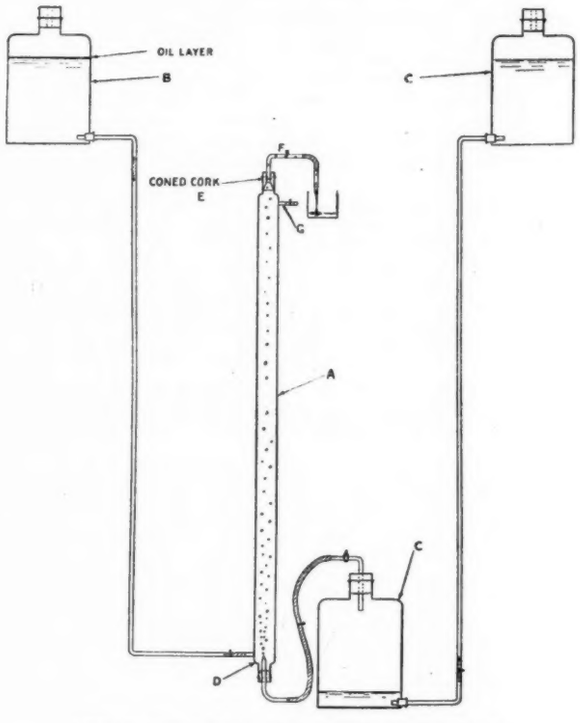
"This statement," say the authors, "shows how a frequently expressed opinion may in course of time tend to become accepted as a fact. That aeration does take place from the surface has been clearly shown by the experiments of Adeney, Leonard and Richardson. Moreover the natural aeration of lake water must be due largely to surface aeration. Under certain conditions this may not suffice to aerate the whole body of water and trouble may ensue if, for example, the drinking water intake is too deeply submerged.

"These facts make it possible to design small sewage purification plants on what may be described in general terms bio-aeration lines, with very little artificial aeration, if the tank is sufficiently shallow. This accounted for the success of the so-called aero-anaerobic tank employed many years ago by Montgomery Neilson for the purification of sewage from isolated dwellings. In this case a slight artificial aeration and movement of the surface was caused at each flush of water in the receiving chamber of the tank." Mr. Fowler had designed a tank only 18 inches deep which was quite successful in providing surface aeration.

But while they concede the importance of surface aeration, the authors by no means admit that the aeration taking place at the surface of innumerable bubbles is negligible. "Ordinary experience in the solution of gases in liquids is opposed to such an idea," they say, "and in the pioneer experiments by Ardern and Lockett it was shown by quantitative measurements that the efficiency of aeration was greatly increased when diffusers, rather than ordinary pipe nozzles, were employed for introducing the air.

"The possible criticism remains that even so the bulk of the aeration comes by 'streaming' from the upper surface when the bubbles break.

"In order to meet this criticism the authors de-



APPARATUS FOR STUDYING AERATION

vised an apparatus in which bubbles of air were passed through a column of water under such conditions that no streaming from the surface was possible, the bubbles breaking outside the main body of water.

"The apparatus is shown in the accompanying diagram. A is the aeration cylinder, and consists of the outer jacket of a Liebig's condenser about 3 ft. in height.

"B is a reservoir bottle containing water approximately freed from air by bubbling carbon dioxide through it. Further access of air to the water of the reservoir is prevented by a layer of oil.

"C are aspirators, by means of which the air can be introduced into the cylinder through the fine jet D.

"The aerating cylinder is closed by a cork E, coned out in such a way as to avoid any entrapping of air. Through the cork passes a narrow glass tube bent at right angles, and attached to a piece of narrow flexible indiarubber tubing for facility in taking samples.

"The experiment was conducted as follows: Air-free water was passed at a slow rate through the aerating cylinder out through the cork E and the narrow tube F. A sample of water was allowed to flow thus into a sampling bottle, and the dissolved oxygen determined; the amount present was found to be quite small.

"The de-aerated water was then allowed to remain in the aeration cylinder for twenty-four or forty-eight hours in order to see what amount of aeration, if any, took place through streaming effect when the apparatus, including the exit tube, was quite full, and when it was full to an inch or so below the cork, thus leaving a surface exposed equal in area to the section of the cylinder. Finally air was admitted through D in slowly moving bubbles about the size of lentils, the water also being kept slowly moving as indicated in the diagram. Under these circumstances no accumulation of air took place below the cork, and no bubble could break till it reached the outlet of the narrow exit tube F.

"After allowing air to pass for the required time it was shut off, the water still continuing to move through the apparatus. As soon as the last bubble of air had passed out a sample of water was taken, and its dissolved oxygen content determined.

"The results are given in the following table, the figures being the actual amount of oxygen present in the sampling bottle, which had a capacity of rather more than 200 cc.

DISSOLVED OXYGEN (mgms)

No. of expt.	A	B	C	D
1	0.3	0.21	1.0	1.60 (½ hour)
2	0.45	0.45	0.96	1.56 (10 mins.)
3	0.30	0.32		1.20 (")
4	0.2	0.24		1.00 (")
5	0.2	0.24		1.10 (")

A = original water; B = water left 24 hours in full apparatus; C = water left 48 hours in partly filled apparatus; D = water after aeration for given period.

"It is evident from these figures that a great deal of aeration takes place from the surface of the air bubbles as they ascend the column of water, even when their number and speed is much less than is customary in large-scale operations.

"As a further proof that aeration takes place from the surface of the bubbles, solutions of manganous sulphate and caustic soda were introduced by the side tube G. A white precipitate of manganous hydroxide rapidly became brown as it passed down the cylinder.

"The apparatus can obviously be used for numerous experiments in connection with problems in aeration. The arrangement can also be adopted for experiments on a working scale if required.

"The results recorded in this paper, however, show clearly the truth of the contention expressed by Mr. C. H. Hurd, sewage engineer to Indianapolis, U. S. A., in 'Engineering News-Record,' Vol. 91, August 10, 1923:—

"The advantage of air circulation over such mechanical agitation as we have knowledge of is that with equal opportunity for economy due to the surface absorption of oxygen, there is an assurance of always having a sufficient quantity of entrained air to give positive oxidation throughout the sewage mass."

Atmospheric Aeration In the Activated Sludge Method*

In Great Britain recent efforts to improve the activated sludge process have been directed chiefly toward increasing the efficiency and economy of its operation. As the opinion appears to be held quite generally that the major factor limiting both the efficiency and the economy of this process is the rate at which sewage under treatment can be made to absorb dissolved oxygen, a great deal of study and a considerable amount of capital have been devoted to efforts to develop improved devices for the aeration of sewage under conditions of practice.

Two general methods for accomplishing this purpose have been studied rather extensively. First, the original method of forced aeration, whereby air, containing its normal percentage of oxygen, is liberated in the form of a fine jet or spray at the bottom of a tank containing a properly proportioned mixture of sewage and activated sludge. The second and later method has been that of stimulating, by artificial means, the natural absorption of oxygen by the sewage from the overlying atmosphere. The forced aeration method is the one used most widely in the United States. While there is diversity of opinion on the subject in England, the weight of current opinion there seems to be that even where forced aeration is used, a large proportion of the oxygen taken up by the sewage is absorbed directly from the overlying atmosphere.

For surface aeration, two distinct systems have been developed one, known as the "Simplex" system, developed by Messrs. Ames & Bolton and

*Abstract from report by H. W. Streeter, sanitary engineer, U. S. Public Health Service, on "Municipal Sanitary Engineering Practice in Great Britain."

patented, and the other the "bioaeration" system originated by John Haworth at Sheffield. The Simplex method depends on the absorption of atmospheric oxygen taking place at the surface of the liquid when it is agitated by means of a revolving cone carrying properly shaped vanes supported on a vertical shaft. The revolving cone is usually placed near the surface of the sewage in a central pipe or shaft. Vertical circulation is induced by the action of the propellor in drawing the liquid upward through the shaft, from which it is discharged radially at the surface. From information gathered at various sources, the impression was gained that the Simplex system of aeration produces an excellent effluent, requires the use of a relatively small area for tanks, and is very economical with respect to power consumption, it being stated that it requires less than 20 h.p. per million gallons daily of sewage treated. On the basis of the cost of the plant at Epsom, which has been designed for a capacity of one-half million gallons per day, the first cost of installation would be about $110,000 per million gallons of daily capacity, and the cost of operation about $12 per million gallons treated.

The bioaeration method of surface aeration, often termed the Sheffield system, is dependent upon the absorption of atmospheric oxygen by the sewage liquor as it flows through a series of channels, in which it is agitated at intervals by overhead revolving paddle wheels and has a velocity sufficiently high to maintain the activated sludge in suspension. Owing to the desire of Mr. Haworth that the process be made available to various communities without restriction, it has not been patented and is not being developed commercially.

At the original bioaeration plant at Sheffield, each aeration unit, which is capable of treating 1½ million gallons of sewage daily, consists of series of connected troughs 6 feet wide, 4½ feet in average depth, and having a total length averaging 5,540 feet. The total cubic capacity of each unit is roughly 900,000 gallons, providing approximately 13 hours for aeration of the sewage. The total area of each aeration unit is approximately 0.8 acre.

Aside from the unique method used for aerating the sewage, the features of the plant which impressed Mr. Streeter particularly were the high degree of purification obtained, the comparative simplicity of its mechanical operation, and the absence of disagreeable features such as unpleasant odors and the prevalence of insects, which frequently are observed in large sewage treatment works.

The quality of the final effluent, when compared with that of the raw sewage, which, like other British sewages, is fully twice the strength of normal American sewage, appears to be remarkably high. At the time of the visit, the effluent was almost perfectly clear, practically colorless, and free from any perceptible odor. According to some figures given by Mr. Haworth in a published paper, the five-day oxygen demand of the effluent, incubated at 65% F., ranged in one series from 8.4 to 27.2 parts per million and averaged 14.2 parts for the series. Mr. Haworth states that its bacterial contents, as determined by plate count, ordinarily averages less than 50,000 per cubic centimeter.

The total cost of the bioaeration process appears to be about the same as that of other methods of activated sludge treatment which thus far have been developed. Mr. Haworth estimates from his experience at Sheffield that the cost of installation would range from about $125,000 to $150,000 per million gallons daily capacity, and his figures for the unit cost of operation, when reduced to their American equivalent, would be slightly less than $12 per million gallons of sewage treated. The depreciation and cost of maintenance is probably lower, however, than that of the other systems described, owing to the fact that practically no piping is used and the only machinery connected with the plant, aside from the usual pumps, is the paddle wheel mechanism which is slow moving and extremely simple and durable. The total cost of the mechanical maintenance of the Sheffield aerators during their six years of service is stated to have been less than $10.

The area occupied by this type of process appears to be about twice that which is required by those using the forced or the Simplex method of aeration, when reduced to a common basis of sewage volume treated. At Sheffield, for example, the area required per million gallons daily of sewage aerated is approximately 0.5 acre. At the Withington plant at Manchester, where the forced aeration system is used, the corresponding unit area required for the aeration tanks is slightly less than 0.2 acre. At Epsom, where the Simplex process has been installed, the area required for the aeration tank is approximately 0.27 acre per million gallons daily of sewage aerated. The larger area requirement for the Sheffield system as compared with the other aeration systems described would place it at a slight disadvantage where the amount of land available for sewage treatment is very limited, or where the value of such land is so high as to impose the greatest possible economy in its use for sewage treatment purposes. In other instances, however, where economy of area is not a highly important consideration, the advantages of the Sheffield system as regards mechanical simplicity and its relatively high purification efficiency are likely to be decided factors in its favor.

Pollution of Wells via Ground Water

The U. S. Public Health Service has published in Hygienic Laboratory Bulletin No. 147 a 168-page description of a study made by C. W. Stiles, H. R. Crohurst and Gordon E. Thomson of the bacterial and chemical pollution of wells via ground water, and the factors involved. The following synopsis of this, prepared by Mr. Crohurst, is published by the Public Health Service in "Engineering Abstracts" for September 3.

"In this publication there are assembled the results of nearly three years of experimental study of the artificial contamination of ground water, bacterially by sewage organisms and chemically with the dye, uranin, in the vicinity of Fort Caswell, North Carolina. The data presented include the geology and hydrology of the experimental area, the types of experimental wells and pits used, meteorological observations, ground water elevations, detailed results of the spread of pollution by the aid of tables and diagrams and the technique employed in conducting the investigation.

"Briefly summarized, the results of the study indicated that: (1) The soil and ground water at the experimental plot were free from B. coli contamination prior to the artificial dosing of pits and ground water; (2) B. coli was recovered from the ground water in 1,213 samples taken under the most rigid technique at distances varying from 1 to 232 feet away from experimental trenches into which uranin and excreta pollution were placed; chemical pollution (uranin) was recovered from experimental wells up to 450 feet from the same trenches; (3) both uranin and B. coli traveled in only one direction, namely, in the direction of ground water flow and did not appear to expand laterally (in a fan shape) with the trench as the apex of a section of a truncated cone but on the contrary it appeared to contract to narrower breadths, with the trench representing the base of a truncated section of a cone; (4) B. coli tends to localize in the upper blanket at or near the ground water table and water samples in a given well, from this blanket, may show heavy B. coli pollution while water a few inches lower may be B. coli free; (5) when the ground water falls B. coli tends to filter out into the capillary fringe or (in case of still further fall) into the soil and if the soil remains dry sufficiently long, B. coli dies. Wet weather (with high ground water) is therefore conducive to the extension of pollution, dry weather (resulting in the lowering of the ground water) is inhibitive to the extension of pollution and conducive to purification of the ground water; (6) chemical pollution, uranin, appeared to float out in a blanket at or parellel and close to the ground water table and tends to filter out (upon fall of the ground water) into the capillary fringe and soil but does not seem always to rise with higher ground water; (7) experimental B. coli infection of the ground water remained alive for two years and eight months at the date of last examination (June 18, 1925) and that uranin remained visible in the ground water for two years and seven months when last examined (June 5, 1925); (8) the changes of the ground water elevations appear to be very complex and of at least four kinds: (a) upward trend of the ground water table more or less generally attributed to hydraulic pressure from some point upstream: (b) the superposition of new ground water by transit from surface water downward to an old ground water table; (c) a new ground water table due to a flow of new water from upstream over a former ground water table, and (d) a wave flow from upstream over a former ground water table. These movements seem to play an important role in the progression of the pollution, carrying the bacteria along to more distant points."

Dual Water Supply Considered

The question of furnishing a dual water supply for Wichita Falls, Texas, was discussed before the Ninth Texas Water Works Short School by N. T. Veatch, Jr. Lake Wichita, which is the source of the present water supply for that city, is a satisfactory soft water for domestic purposes; but the quantity will not much longer be sufficient for all purposes, and another source of supply will be necessary. It might be possible to draw upon Lake Kemp, which is saline and very hard but might be used in a separate system of mains for irrigation and fire fighting purposes. However, Mr. Veatch, after considering the relative cost of single and dual systems, came to the conclusion that dual systems are more expensive in first cost and in operation than single systems, owing to duplications of pipe lines, services, pumping plants and accessories; and that some unusual situation, such as the inadequacy of a suitable water supply together with an unusually high cost for an additional supply or for excess treatment, must exist before a dual supply can be economical.

Sanitary Work in the Flood Area

Details of work done, as told by one of the District Health Officers

On April 29, during the height of the Mississippi Flood, officials of the Red Cross and health officers of the states affected asked for aid from other states, in response to which eight public health men and three sanitary engineers from five states arrived at Memphis, Tennessee, on May 3. Because Arkansas was most in need of such men and also because the waters there had begun to recede it was decided to send all of these men into that state, which was divided into six areas or districts, and later, as more men volunteered, into fourteen districts. The men assigned to each district were designated "district health officers" and represented directly the Arkansas State Board of Health. Each health officer was furnished with a duffle bag which could be strapped on his back, and a pair of rubber boots. The bag contained a stethoscope, hypodermic, thermometer, distilled water, adhesive plaster, etc; also tetanus and diphtheric serum, a sterno outfit for sterilization, and a flashlight. The men left for their respective districts on May 5.

The general objectives set were the coordination of local health officials, Red Cross and civic organizations, relief of the stricken people, protection against disease, and disposal of dead animals. More specifically, the objectives sought were the protection of the drinking water, the proper disposal of human wastes, and inoculation against typhoid; together with screening houses, distribution of quinine, the draining of ditches and the oiling of pools for the prevention of malaria.

One of these districts, containing 2,649 square miles with a population of about 94,000, was assigned to Howard A. Lanpher, epidemiologist of the Connecticut State Department of Health. In a recent issue of the monthly publication of that department, Dr. Lanpher describes some of the intimate features of his work.

His headquarters was Clarendon, with a normal population of 2,638, practically all of whom had been driven from their homes by a break in the levee.

This had occurred in the middle of the night and 150 houses were swept from their foundations and floated away and about 200 more were twisted off their foundations but remained on the original site. The least amount of water in any house was two feet and in many instances the water was above the second floor. The receding flood left a deposit of slimy filth a quarter of an inch thick on the inside and outside walls and on all furniture, and a deposit of mud from 1 1-2 to 2 inches thick on the floors. Paper was soaked from the walls and the floor boards and mop boards were warped.

Dr. Lanpher arrived there on May 7. The water was still over the running boards of his car and conditions were discouraging and people discouraged. Many had lost everything save the clothes they had on and these were soaking wet after three days' rain. That afternoon a meeting of the citizens was held and committees appointed for looking after the food, housing, cleaning up and medical problems. A sum of $4,000 had been promised by the Red Cross and 300 mattresses and an appropriate amount of bedding were assured. The Red Cross agreed to hold in readiness for shipment to Clarendon within twelve hours sufficient equipment for an emergency hospital but it was not needed. The Governor agreed to loan twenty-four convicts from the State Penitentiary, which the railroad transported without charge, which convicts reached there on May 10. On Sunday, the 15th, approximately 8,000 people motored over the only passable road into Clarendon in order to view the "worst stricken city in Arkansas," but an emergency had been declared and this road had been closed to all except those having legitimate business; otherwise the clearing up of the street would have been greatly interfered with. The convicts first cleaned up the streets then put back on their foundations the buildings which had been moved by the flood. Storekeepers and housekeepers placed their wet and sodden belongings on the sidewalks and ten mule teams hauled them to a public dump, where they were spread out to dry and were burned as soon as dry enough.

Meantime the problems of water supply and sewerage had to be given attention. Clarendon had had a municipal water supply from two artesian wells 178 and 200 feet deep, respectively, and also had had a sewerage system. Pumping plants for these systems were situated about 50 yards inside the levee and during high water there had been 45 feet of water over the bottom of the pump pit. As soon as the water subsided sufficiently, a pipe had been driven through the water to a depth of 12 feet into the ground and was used for supplying the entire town; this being placed in the lawn of the county court house which was centrally situated and about the highest land in the town. This water was drunk without treatment until the arrival of Dr. Lanpher. Following his arrival 12 galvanized iron wash tubs were obtained from a hardware store, cleaned from the filth which covered them and set on a stand about 12 feet from the well and filled with water from the pump. Calcium hypochlorite was added to make the water safe and the population was required to drink this treated water only. People objected to the unfamiliar taste and endeavored to pump fresh water for themselves but this was prevented by unscrewing the pump from the well each time after filling the tubs.

As soon as possible the pump pit was baled out and the pump cleaned up, and a fire was started under the boiler when the water had receded only one inch below the grates. In two days the mains had been flushed out and the chlorinating machine hooked onto the supply pipe. Thus a safe supply of water was furnished 19 days after the flood. The sewerage system had suffered only a few breaks from the flood and this was put into operation the next day.

After these matters had been settled, attention was given to the inoculation of the people against typhoid fever. During the next six weeks, 18 clinics were established at which about 6,000 people received inoculations, these being mostly from the rural districts where local doctors could not go. Only three cases of typhoid fever occurred among the population of the county, two of which were reported from another county.

There was some dysentery but no cases were serious. Malaria, of course, is always a problem in Arkansas, but there seemed to be no increase in the number of cases. Cases of pellagra were numerous, seeming to be aggravated by the restriction in diet due to the difficulty of procuring a balanced ration.

With these matters in a fairly satisfactory condition, attention was paid to the rehabilitation of the people in their homes, the rebuilding of homes where necessary, replacement of live stock and other items in the general clean up.

Importing Cast Iron Pipe

In spite of the tariff and the lowering of price of cast-iron pipe which has taken place during the last year or so, there is importation by this country of a small amount of cast-iron pipe from Europe, chiefly from France. The cast-iron pipe industry has been considerably exercised over the fact that any pipe is imported and has furnished to the press, both technical and popular, many arguments why this is to the disadvantage of the country at large.

This opposition to foreign competition is not confined to this country, but is found in other countries; and in the "shop at home" movement in the cities of our own. An illustration of the universality of the idea is offered by a letter in the August 12 issue of "The Surveyor," an English paper, written by the director of an ironworks company. He said: "I have recently received a letter from an engineer well known in the industrial and gas world, which sets out a series of well-reasoned arguments to show that in national interests purchasers of materials should, as far as possible, refrain from buying abroad; and saying that in the case of cast-iron pipes buyers are inclined to introduce competition from abroad in consequence of an alleged existence in this country of an association for controlling prices of the home-made product On making further inquiries afield I find the belief to be prevalent that the price of British-made cast-iron pipe is controlled, or in some way regulated, among the several makers. I would therefore like emphatically to state that since the Cast-Iron Pipe Association was dissolved some four years ago, prices have been free and in no way controlled.

"Probably in no article of commerce does the direct cost of wages absorb so large a portion of the selling price of an article as does the cast-iron pipe and the raw materials required in its production. In short, it takes 7 tons of British material to produce 1 ton of cast-iron pipe. It follows, therefore, that for every 1 ton of pipes imported the country is deprived of the wages paid in the getting and manufacture of 8 tons of materials—wages paid, direct and indirect, representing by far the greater portion of the selling price."

This sounds very much like the argument advanced by the manufacturers of the United States; which is, in brief, that to save $100 in the cost of pipe, a city may send to a foreign country $1,000 or more which would otherwise go to labor in this country and be spent in the city in question, or other cities of this country, for clothing, automobiles, radios, food, or other local products—a net loss to the country of $900.

Sewer Construction in Worcester, Mass.

Adoption of modern machinery, including pneumatic tools, reduces cost of both construction and maintenance. Modern cost-keeping records

The Sewer Department of Worcester, Mass., laid 11.23 miles of sewers during 1926, the greatest mileage laid in any year since 1900; and on the basis of capacity of sewer, it surpassed any previous year. The largest pipe was 82-inch.

Much of the work was carried on under very difficult conditions, involving excavating through ledge, water and peat. In one job it was necessary to drive 30-foot piles in order to provide a safe foundation for the sewer. Some of the excavations were quite deep, the maximum depth being 28.5 feet.

The adoption of modern machinery aided the department materially in performing this work. Said Andrew B. Holmstrom, superintendent of the Sewer Department, in his report for 1926: "It is interesting to compare the year 1913 with this last year. In 1913 the average number of men employed for the whole year was 262; the maximum, 374. As noted above, 9.11 miles of sewers were constructed during that year, and no pipe greater than twenty-four inches in diameter was laid. This year two miles more of sewers were constructed, with an average number of men for the whole year of 276, maximum number 311, and the largest size sewer was 82 inches in diameter. The capacity of the sewers laid in 1913 was 581,834,629 gallons; in 1926, 1,310,337,349 gallons. The difference in the amount of work accomplished with practically the same number of men must be credited to modern machinery and modern methods.

WORCESTER SEWER TRENCHING EQUIPMENT

"During the past year pneumatic tools of all kinds have been adopted; modern pile driving equipment and trench equipment purchased. The trench hoe, our latest addition to the department, has helped materially. We find that it has paid for itself several times. A tractor equipped with back-filling scoops has accomplished a great deal in keeping down the costs, and also in keeping the jobs closed up, which is a matter of considerable importance nowadays, because of the tremendous traffic that passes over our streets.

"The department has adopted modern cost-keeping records, which have aided materially in providing exact knowledge at all times in regard to the cost of work, thus enabling the department to control expenditures more efficiently."

The average wages paid all of the employees on sewer work was $31.14 per week, the minimum wage for adult laborers for eight hours being $4.64. The total pay roll for the year for labor was $447,438.

Machinery was used on maintenance work also. Catch-basing cleaning machines removed 10,946 cubic yards of material from 4,341 basins which were cleaned an average of approximately twice. The cost was $1.57 per cubic yard. "The cleaning of sewers by the use of scrapers has been greatly facilitated by the adoption of a Hyster double-drum hoist on a Fordson tractor," said Mr. Holmstrom.

The cost of maintenance of the sewers, a total of 282.33 miles, in 1926 averaged $212.36 per mile. This is the lowest average since 1919, when the cost was $207.45 per mile. In 1920 the cost jumped to $247.58 per mile and since that date has steadily fallen. The lowest cost for fifty years past was $110.47 in 1898.

Public Work Increases

State and municipal bond sales in August, 1927, totalled $84,160,179, excluding temporary loans, New York City "general fund" bonds, and Canadian issues, and the total for the first eight months of the year is over a billion dollars, according to the *Commercial and Financial Chronicle*. The only other year showing figures as high was 1924, when the sales for the first eight months totalled $1,014,088,919. The 1927 figures show an increase of $130,625,213 over the same period for 1926.

The following table, which shows the sales of State and municipal bonds for similar periods during the past year, illustrates the tremendous expenditures

in the great field of public improvements, and the increase during the last decade.

Year	*August*	*Total for Eight Months*
1927	$84,160,719	$1,005,150,938
1926	71,168,428	874,525,725
1925	83,727,297	980,196,064
1924	108,220,267	1,014,088,919
1923	56,987,954	709,565,710
1922	69,375,996	819,078,237
1921	94,638,755	665,366,366
1920	59,684,048	439,355,455
1919	59,188,857	448,830,120
1918	38,538,221	213,447,413

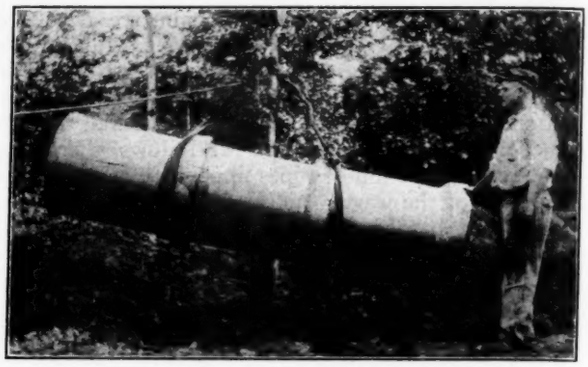
Laying Water-Tight Sewer in Swamp

Sewer laid in cradles through swamp. Asphaltic jointing material used. Methods of handling pipe and making joints

By John O. Miller, M. Am. Soc. C. E.

The city of Quincy, Massachusetts, is constructing a 24-inch storm sewer through Faxon Park Playground, the contractor being E. J. Sandberg, and the work being done under the supervision of Superintendent of Sewers McKenzie. An interesting feature of this work is that the sewer is located in an old swamp carrying a large amount of ground water, in spite of which there has been practically no infiltration in the several hundred feet of vitrified clay pipe that had been laid at the time the writer visited the work.

The sewer is supported on a wooden grillage or platform resting upon piles, which piles are driven ahead of the excavation. After trenching has been completed the piles, together with prehistoric stumps which have been uncovered by the excavation, are cut off at grade and the grillage is then placed thereon. On the platform are set wooden cradles



READY TO LOWER TO PLACE IN THE TRENCH

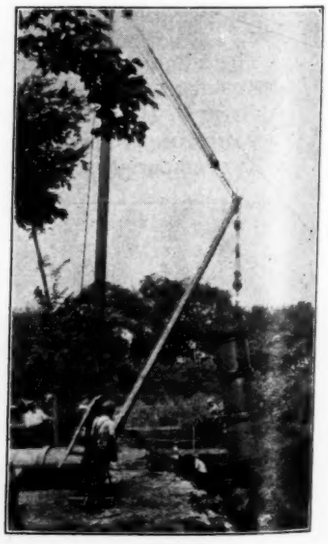
to receive the vitrified pipe, these being set to the proper line and grade. When the pipe has been laid, earth is tramped under and around it, so that all of the weight will not have to be supported by the pipes acting as beams resting on the cradles or bells. All joints are being made with "Sewer Seal" asphaltic compound, which Mr. Sandberg is using in order to simplify and cheapen the laying of the pipe. He also improves the average quality of the joints by laying two or three three-foot lengths of pipe as one unit, these being jointed together on the ground before being lowered into the trench. Where the trees crowd the trench, two-pipe units are used and in this case an ordinary tripod with blocks and falls are used to lower the pipe, which has previously been rolled to place on the bank. Where there is room, however, three-foot lengths are used and are handled by means of a small stiff-leg derrick. An ordinary crab is used on the mast and a stick slung across the main pinion is used as a brake when lowering the pipe into place. The three-pipe units, weighing about 1,350 pounds, can be handled from start to finish by two men with an occasional third man called in for a few minutes. It has been the contractor's practice, for safety, to place slings on both upper pieces of pipe while swinging the three-length unit to the edge of the trench.

An ordinary cast-iron pot of about ten gallons

EXCAVATED TRENCH SHOWING FOUNDATION PILES AND WATER

ACCUMULATION OF WATER WHEN PUMP HAS STOPPED FOR A FEW MINUTES

CAULKING THE UPPER JOINT



SWINGING TO PLACE ON THE SIDE OF THE EXCAVATION

capacity is used for melting the asphalt compound and an abbreviated coal scuttle for pouring it into the bells of the pipe. One strand of dry jute is calked into the annular space before the joint is poured. Where the joints are poured on the bank, the vertical position of the pipe makes it unnecessary to use a runner to retain the hot asphalt; but in the ditch a square-section braided runner is used. This is tightened and held in place by means of a woodworker's clamp or vise. The runner is kept well wet and coated with clay while the compound is being poured.

In spite of the fact that each length of the vitrified clay pipe used weighs some 450 pounds, there has been no sagging, springing or opening of joints during the handling of the pipe in this way.

Future Pumping Station Used for Sewage Treatment

Plant designed for treatment by sedimentation and chlorination provides for present necessities but when desirable can be converted in sewage pumping station serving six times the area

By H. Burdett Cleveland*

The village of Patchogue, Suffolk county, Long Island, N. Y., recently constructed a sewage treatment plant to provide against contamination of shellfish grounds in Great South Bay. The area served by the tributary sewer system covers but a small part of the village and the proportion of the total population thus provided with sewage disposal facilities is less than one-third. No considerable volume of additional sewage can be delivered by gravity to the present outlet point through the existing collection system, although the natural drainage area within the village limits which would drain to this point is considerably larger than the sewer district served.

The sewer system, which covers principally the business section, was commenced in 1882 as a private system and has been extended from time to time under private ownership until purchased in 1925 by the Sewer District established within the village limits in accordance with the provisions of a recently enacted New York State law.

This law authorizes the setting up of separate sewer districts within the boundaries of incorporated

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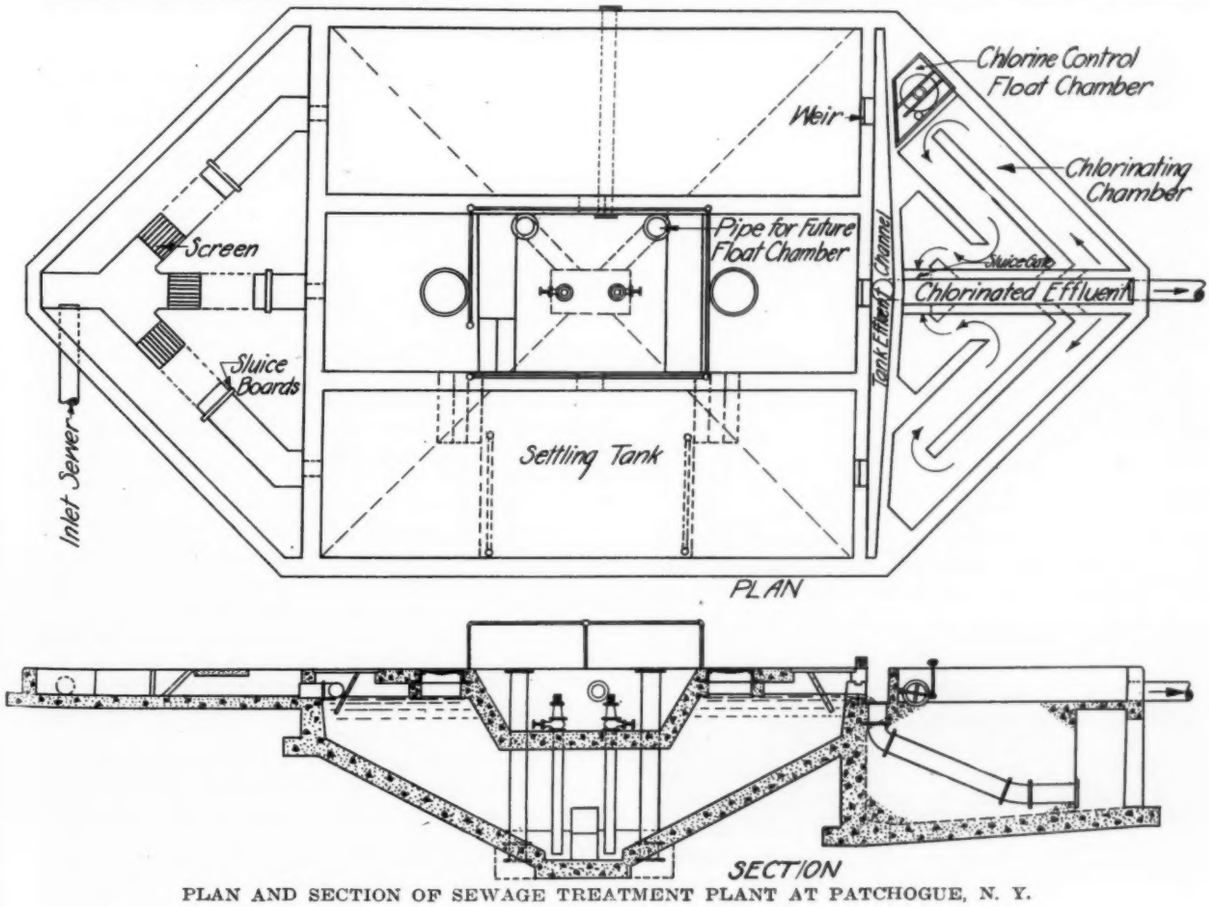


PLAN AND SECTION OF SEWAGE TREATMENT PLANT AT PATCHOGUE, N. Y.

villages in Suffolk county. Such procedure, in general, is contrary to the best interests of the villages concerned, on both sanitary and economic grounds, although the law was deemed expedient by State authorities as a means for earlier correction of oyster bed pollution than would otherwise be possible.

Under the conditions existing and in view of the lack of support from the taxpayers for the construction at this time of a general sewer system covering the entire village, the Board of Trustees arrangd for the establishment of the sewer district and the construction of a sewage treatment plant to care for the sewage from the limited district as well as the sanitary sewage from a lace mill adjacent to the district.

The total population of the village is about 5,200. The plant serves a present population, including operatives in the lace mill, of about 1,000.

The treatment consists of sedimentation in a three-compartment, single-story, hopper-bottom settling tank, followed by chlorination. Sluice gates set in the bottom of the longitudinal division walls permit the passage of sludge from the outer compartments to a central sump. The entire plant is housed over by a brick structure.

The special problem to be met in the design and construction of this plant was to provide for the present necessities of sewage treatment without sacrifice of construction investment, later, when adequate sewerage and sewage disposal facilities for the entire village should be decided upon.

The site available for a treatment plant near the point of discharge from the present system into Patchogue river, at the foot of Hammond street, was not considered suitable as a permanent disposal plant site or for sludge drying, either on uncovered or covered beds, since the location is but 500 feet from the main street of the town and lies on the windward side of the most thickly developed section of the village.

The plant was designed, therefore, to serve efficiently as a settling tank for the present, and to be converted later, with no change in construction, into a sewage pumping station. As a pumping station it will serve an area nearly six times the area of the existing sewer district and will have sufficient capacity to care for that portion of the village naturally tributary to it under a general sewerage plan.

While the plant is being operated as a settling tank, the sludge will be pumped into a tank truck (which can be backed into the building) and conveyed to sludge drying beds northeast of the village.

When the plant is converted into a pumping station, the threaded nipples and the reducers over the valves on the sludge suction pipes will be removed and horizontal, direct connected centrifugal pumps will be bolted to these valves and connected to a force main leading to a main sewage disposal plant for the village. The first portion of the force main is in place through the walls of the tank.

BUILDING NOW HOUSING SEWAGE TREATMENT PLANT

Two 12 inch pipes for use as float chambers to provide for automatic operation of the pumps are in place, as shown. The pumps will be self-primed.

The plant was designed by the writer and constructed by the Ransom & Anderson Company, of New York, under the immediate supervision of May & Smith, village engineers.

Wet Sludge as Fertilizer*

Test indicates wet sludge, like wet manure, contains more available plant food, and other advantages

By S. Duxbury†

It is a well-known fact that there is not sufficient barnyard and stable manure obtainable on a farm to fertilize the whole of the land of the farm every year, and in many cases a reasonable dressing has to suffice for three years.

Some time ago experiments were carried out by treating two plots with manure, the one receiving a good dressing of fresh farmyard manure, and the other with manure which had suffered from losses due to waste of the liquid excrement. Each plot received the same amount of manure per acre. The results are expressed in percentage of gain over a check plot that received no manure.

	Uncared-for manure, fairly dry.	Fresh manure, solid and liquid.
First year	16.8 per cent	58.8 per cent
Second year	65.2 "	114.3 "
Third year	45.8 "	78.4 "
Average	42.6 per cent	83.8 per cent

The table clearly shows that the yield from the fresh manure (solid and liquid) was very much larger than from the uncared-for manure.

As in barnyard and stable manure, the value of sewage sludge is considerably reduced by de-watering, digestion, drying in beds, pressing and careless handling.

The Bedford sewage disposal works is situated outside the town, and surrounded by a vast area of suitable land, and every possible advantage is taken of the well laid out installation. The land is the means of livelihood of a great number of industrious and speculative people, and it is the desire of this section of the community to obtain the maximum growth of the plant at a low cost, and to retain the color, shape, texture and feeding value.

The application of wet sewage sludge to the land does not mean for disposal purposes only, but to give to the crop a good food supply and a long season of growth, also to provide a substitute for fresh barnyard and stable manures.

The inverts of the sludge outlets of the tanks are at a higher level than the surrounding land, and the whole of the liquid sludge is distributed without be-

*From paper before summer conference of Association of Managers of Sewage Disposal Works, Great Britain.
†Manager, sewage disposal works, Bedford, England.

ing lifted. The sludge in the tanks is varied in moisture content according to the distance of the land from the tanks.

The land is deeply and roughly ploughed, and, if uneven, levels are taken and pegs fixed at the highest points. Earth carriers are constructed to these points, and little labor is entailed in providing suitable channels.

The sludge in the tanks is thoroughly mixed before the sludge outlet is opened, and this operation is continued until the tank is empty. The sludge is thinly and evenly distributed over the surface of the soil, and the rapid reduction of the water-content prevents bio-chemical changes and corresponding mal-odors.

Following a good dressing, the area treated is allowed to rest, the period varying according to season; and when the sludge is fairly dry it is well incorporated into the soil by the plough and harrow.

As in the case of barnyard and stable manure, experiments have been carried out by treating two plots of land with sewage sludge. The sludge (95 per cent moisture) in a tank was thoroughly mixed, one half of the volume being run on to well-drained drying beds to the depth of 4 in., and the remainder of the liquid sludge direct to the first plot to be treated.

The sludge was removed from the drying beds after twenty-eight days, and removed to a covered shed for a further period of drying. The air-dried sludge was distributed evenly and carefully harrowed into the second plot.

	Air-dried sludge (28 per cent. moisture)	Liquid sludge (95 per cent moisture)
First year	38.2 per cent	84.6 per cent
Second year	87.4 per cent	152.8 per cent
Third year	51.6 per cent	94.2 per cent
Average	59.06 per cent	110.5 per cent

The results (see table herewith) are expressed in percentage gain over a check plot that received no manure or sewage sludge. Again the results were in favor of fresh manure or sludge.

Present cost of sludge disposal at Bedford per annum, approximately 12,000 tons wet sludge, 95 per cent. moisture.

	£	s.	d.
Rent of 30 acres of land—50s. per acre	75	0	0
Ploughing, etc.—twice per annum	60	0	0
Labour, sludging tanks	52	0	0
Tools	10	0	0
Constructing channels, etc.	10	0	0
	£207	0	0

Or 4d. per ton of wet sludge.

After a dressing as described above, the land can be readily let at £8 per acre, or £240 for the 30 acres, thus leaving a balance of £33.

CONCLUSIONS

1. Sludge is never so valuable as when fresh.
2. It can be more evenly distributed.
3. Fresh sludge warms cold soils, makes them more porous, and the fermentations that take place during decay tend to make the soil more mellow.
4. The plant food is more available.
5. When spread evenly and thinly, there is no loss of its valuable constituents through early fermentation, etc.
6. The crop is more even.
7. It improves the mechanical condition and drainage of the soil—"this is fully as important as its direct fertilizing value."
8. It is disposed of with advantage at a low cost.

As to the rate at which wet sludge should be applied, no fixed rule can be given. It will depend upon the character of the soil, the nature of the crop, and the frequency of application.

Asphalt Joints for Sewers

In constructing sewers for the city of Tulsa, Oklahoma, Charles Schultz, city engineer, uses asphalt jointing material wherever vitrified sewer pipe is to be laid in wet ground. Mr. Schultz states that about four years ago, in designing some outfall sewers with a total length of 16 miles which would discharge into two disposal plants and in which it was considered advisable to secure watertight construction, he considered the use of asphalt joints for this purpose. He found that the lowest priced material offered especially for this purpose would cost $65 per ton f.o.b. Chicago, to which must be added considerable for freight. The greater part of the pipe to be laid was 18 to 27-inch and a great many tons of the material would be required and he endeavored, therefore, to find a cheaper material which would serve the purpose. After some experiments made with material locally available he finally secured a satisfactory joint by using a mixture of No. 30 Texaco roofing asphalt with limestone dust such as is used in asphalt paving work. This material could be secured at $21 per ton mixed, delivered on the job. This asphalt mixture has been used under varying conditions, and Mr. Schultz reports some 27-inch pipe that has been exposed through two summers and from which the jointing material has not run nor have the joints leaked.

In making the joints, dry jute is first packed in, oiled jute not being used because of the possibility that it would act upon the asphalt. This jute is caulked into the joint so as to leave a uniform depth of 1½ inches for the asphalt. In pouring the joint a rope runner covered with mud is used, as in pouring a lead joint. If there is water in the trench and it is difficult to pour the asphalt joint because of this, he has secured a tight joint by opening up the jute and dipping in the hot mixture and tamping it in while hot with a stick, thereby compacting it into the bottom of the joint.

The specifications require that the runner be left on until the asphalt has cooled, which cooling may be hastened by pouring water on the joint. The asphalt is to be mixed about 40% asphalt and 60% ground limestone 90% of which will pass a 200 mesh sieve, but with a variation of 10% one way or the other, using less asphalt in warm weather and more asphalt in cold weather. All material is proportioned by weight. The mixture is to be poured at as low a temperature as possible and is to be continually stirred so that the limestone will not settle out from the asphalt before pouring. If the inspector sees that the proper temperature is secured before pouring a joint, the desired mixture cannot be greatly departed from, since if there is

too much limestone dust the mixture will not pour and if there is too much asphalt the contractor will lose money. It is specified that the infiltration of ground water shall not exceed 25,000 gallons per mile per 24 hours, and if the infiltration exceeds this amount it must be reduced to this limit before acceptance of the work.

The asphalt and limestone are mixed in a kettle. In laying 8-inch sewer lines, the heating kettle is carried in a steel wheelbarrow with grates below it on which a coal fire is kept going, a stove pipe near the wheel supplying draft, and the wheelbarrow can then be moved along the trench from joint to joint and the material kept sufficiently heated meantime. For sewers up to 15 inches in size it is permitted to join two pipes together on the surface, there being more certainty of obtaining tight joints in this way.

Mr. Schultz reports having laid about 150 miles of 8-inch lateral in this way and considers the method very satisfactory.

Tabulation of Bids

Methods Employed by Tennessee Department of Highways and Public Works

By O. H. Hampsch*

The Tennessee Department of Highways and Public Works has worked out a unique method of tabulation of road and bridge bids, enabling the awards of the contracts in most cases to be made on the day of the letting. Ordinarily, bids are taken about every sixty to ninety days, and totals of contracts amount to $1,500,000 or $2,000,000, and the number of projects average about 15, with 100 to 150 bidders.

In opening the bids the projects are grouped by counties. As each bid is opened and publicly read, a record is made on a bid tabulation sheet, which gives the item, unit bid, contractor and his address. It does not carry the extended total. As soon as the bids for each separate project have been read, they are carried by messenger to computers, who work in squads of two men each. After checking the bond requirements and the copied unit prices, the calculations are made for extended totals, grand total, and a comparison made for time value, which is a determining factor in the award. Each calculation, as well as additions, are checked by the alternate operator, and three lowest bidders noted on tabulation sheet. While the last of the projects are being read, tabulations are being completed on the first ones, enabling the awards to be made on these immediately after the entire reading has been completed.

About 90% of these awards are made the day of the letting which, of course, saves time for bidders and others interested in the contracts. The name of the successful bidder, his address, the amount of his contract, time limit and alternate selected, is posted on a blackboard in the assembly hall. Mimeographed sheets giving the name and address of all contractors submitting proposals are available a few hours after the bids have been read.

Tabulation of bids are neatly lettered from the original calculations on standard forms 11 in. x 17 in. These forms are then photostated down to ¼ original size, making the tabulations 5½ in. x 8½ in. Copies of these are sent gratis to each bidder on the individual project upon which he bid, and are sold to the various bond companies, material companies, or any one interested.

The calculations, checking and printing of these tabulations are handled by the designers and draftsmen of the Plans Division. Monroe and Marchant Calculating machines are used for the computations.

*Chief draftsman, Plans Division, Tennessee Dep't of Highways and Public Works.

Texas Contracts for Road Machinery

Awards by the State Highway Commission of Texas of contracts for road machinery costing $1,325,000 have been announced by R. S. Sterling, chairman of the highway commission, and H. H. Harrington, chairman of the Board of Control, the kinds of equipment and firms supplying each being as follows:

J. D. Adams Company, Indianapolis, Ind.—Graders, ten 12-foot, four 10-foot, six 8-foot, fifty 6-foot horse drawn.

Austin Bridge Company, Dallas, Tex.—Graders, eight 8-foot, 22 power maintainers complete, 130 fresnos, 130 light plows.

Austin Western Road Machinery Company, Dallas, Tex.—Graders, two 12-foot, six 10-foot, six 8-foot, forty 8-foot horse drawn, 10 power maintainers complete.

B. F. Avery and Sons Plow Company, Dallas, Tex.—30 horse-drawn mowers.

STATE OF TENNESSEE
DEPARTMENT OF HIGHWAYS AND PUBLIC WORKS
SUMMARY OF BIDS

STATE ... AID PROJECT NO. 176-C
COUNTY HAWKINS
LOCATED BETWEEN Pressmen's Home AND Lee Valley Road
OPENED AT NASHVILLE TIME 10 AM DATE April 8, 1927
LENGTH OF ROAD 3.790 MILES; BRIDGE ... MILES; SURFACE ... MILES
WIDTH OF ROADWAY ... FT. SURFACING ... FT.
KIND OF SURFACE OR BRIDGE ...
THICKNESS OF SURFACING: CENTER ... SIDES ...
SHEET 1 OF 2

ITEM NO	CONTRACTORS BIDDING / ADDRESS / ITEM	APPROX. QUANTITIES	UNIT	Galloway & Fisher, Lenoir City, Tenn. UNIT PRICE	AMOUNT	M.T. McArthur, Johnson City, Tenn. UNIT PRICE	AMOUNT	Albert Lyons, Rogersville, Tenn. UNIT PRICE	AMOUNT	Harrison, Walters & Prater, White Pine, Tenn. UNIT PRICE	AMOUNT	R.S. Freeman, Knoxville, Tenn. UNIT PRICE	AMOUNT	E.V. St. Martin, Gate City, Va. UNIT PRICE	AMOUNT
1	Common Excavation	18,408	Cu. Yds.	60	11,044 80	50	9204 —	47	8651 76	55	10,124 40	40	7363 20	42	7,731 36
2	Solid Rock "	2,124	" "	60	1,274 40	1 10	2336 40	78	1,693 —	2 —	4,248 —	1 25	2655 —	1 15	2442 60
3	Culvert - (unclass)	235	" "	1 50	352 50	1 50	352 50	1 —	235 —	1 50	352 50	1 —	235 —	50	117 50
7	Borrow Excavation	184	" "	50	92 40	40	61 60	47	72 39	50	92 40	40	61 60	42	64 68
45a	Eighteen(18)in C.M. Pipe	636	Linft	2 70	1,717 20	2 50	1590 —	3 —	1,908 —	2 —	1272 —	2 25	1,431 —	1 60	1017 60
45b	Twenty four(24)in C.M. Pipe	756	" "	3 20	2419 20	3 —	2268 —	4 —	3,024 —	3 —	2268 —	3 25	2457 —	2 75	2079 —
	TOTAL				16,900 80		15,812 50		15,484 14		18,357 30		14,202 80		13,452 74
	Timoteius				1,800 —		1,500 —		2,500 —		2,000 —		1,200 —		1,200 —
	TOTALS FOR COMPARISON				18,700 80		17,312 50		17,984 14		20,357 30		15,402 80		14,652 74
	TIME TO COMPLETE			90	WORKING DAYS	75	WORKING DAYS	125	WORKING DAYS	100	WORKING DAYS	60	WORKING DAYS	60	WORKING DAYS

CONTRACT AWARDED TO Reynolds Constr. Co. White Pine, Tenn. TYPES OF ALTERNATES SELECTED ...
TABULATED BY O.H. Hampsch TRACED BY J.H. Holt REMARKS: ... APPROVED BY R.H. Parks
CHECKED BY B. Smoot CHECKED BY H. Jay Kimbrell TITLE Asst. State Highway Eng'r.

SAMPLE OF SUMMARY OF BIDS

Benson Motor Company, Austin, Tex.—Twenty-five 1½-ton trucks.

Browning Ferris Company, Dallas, Tex.—14 power mowers and 50 asphalt heaters and 12 rotary sweepers.

The Coppedge Company of Texas, Austin, Tex.—Six 5-ton tractor-graders, four 12-foot, four 10-foot, four 8-foot, forty 8-foot horse drawn, 30 maintainers for power maintainers.

Hubb Diggs Company, Fort Worth, Tex.—30 power maintainers complete.

Electric Wheel Company, Quincy, Ill.—Four 5-ton tractors.

James W. Francis Company, San Antonio, Tex.—Sixteen 5-ton tractors, 20 tractors for power maintainers, 16 power maintainers complete.

Freeman & Taylor, Rosebud, Tex.—10 tractors for power maintainers, one power maintainer complete, 12 Rooter plows, twenty 1½-ton trucks.

R. B. George Machinery Company, Dallas, Tex.—Twenty 10-ton tractors, sixteen 5-ton tractors.

Indiana Truck Corporation, Marion, Ind.—Twenty-five 1½-ton trucks.

Lewis Patten Company, San Antonio, Tex.—Ten 10-ton tractors, eleven 5-ton tractors, 15 power maintainers complete, graders four 8-foot, forty 8-foot horse drawn.

Lynn Motor Company, Port Arthur, Tex.—30 power maintainers complete, forty 1-ton trucks.

Lone Star Road Machinery Company, Dallas, Tex.—Graders, four 12-foot, six 10-foot, six 8-foot, forty 8-foot, horse drawn; four portable crushing and screening plants complete, five 5-ton rollers.

Mack International Motortruck Company, Dallas, Tex.—Eighteen 1½-ton trucks.

Moline Implement Company, Dallas, Tex.—40 horse-drawn mowers.

John E. Morris, Dallas, Tex.—10 power maintainers complete, 20 maintainers for power maintainers, five 5-ton rollers.

Reo Motor Company, Dallas, Tex.—Thirty-four 1½-ton trucks.

South Texas Implement Company, Houston, Tex.—20 power maintainers complete.

Steel Products Corporation, El Paso, Tex.—Five crushing and screening plants complete.

Tri-State Motor Company, El Paso, Tex.—20 tractors for power maintainers, five 5-ton rollers.

The Walter Tips Company, Austin, Tex.—Graders, two 12-foot, one 8-foot.

Whelton & Townsend, Houston, Tex.—Six air compressors mounted on trucks.

Wichita Falls Motor Company, Wichita Falls, Tex.—Ten 1½-ton trucks.

Alamo Iron Works, San Antonio, Tex.—150 fresnos.

J. W. Bartholomew Company, Dallas, Tex.—34 light plows, 10 Rooter plows.

W. H. Richardson & Co., Austin, Tex.—100 fresnos, 26 light plows.

John C. Ross Hardware Company, Austin, Tex.—20 Rooter plows.

Southern Implement Company, Dallas, Tex.—32 light plows.

Western Wheeled Scraper Company, Dallas, Tex.—70 fresnos, 32 light plows.

"Turnover" Method of Road Oiling

The California Highway Department has developed a method of applying asphaltic oil to gravel road surfaces which has been given the name of the "turnover" method, and which is considered to produce an excellent road at low cost. In June of this year E. B. Bail, assistant engineer, New Mexico State Highway Department, who had been assigned to study the method with a view to its adoption by that department if found suitable for New Mexico conditions, spent a week carefully observing actual operations by this method in the vicinity of Barstow, California, and examining completed roads in that state. His report is the unusual triple combination of a clearly written, logically arranged, comprehensive description, by one whose experience and knowledge enabled him to apprehend and comprehend the significance and fine points of all he saw, of a work of unusual importance to highway engineers and contractors.

By the courtesy of the New Mexico Highway Journal, official publication of the State Highway Commission, through its editor, R. W. Bennett, office engineer of the commission, we are enabled to publish the essential features of Mr. Bail's report, which are as follows:

Essentially the present California practice consists in applying one and one-half gallons per square yards of 60-70 per cent asphaltic oil to a gravel or crushed rock surface and then thoroughly mixing this oil with the surfacing to form an oil cake about 3 inches thick.

Barstow, California, at which point this work was being done, lies at an elevation of approximately 2100 feet. The surrounding country is desert. The rainfall is about that of the most arid sections of New Mexico. High winds prevail during the spring months.

The road being treated by the 'turnover" method was a Federal Aid Project surfaced with crushed gravel 6 inches thick, 18 feet wide. It had been constructed in the early part of 1926.

Screen analyses were made of material from several pits. The analysis shown below is of material taken from the pit finally used. It represents that part of the sample passing a ½ inch hole.

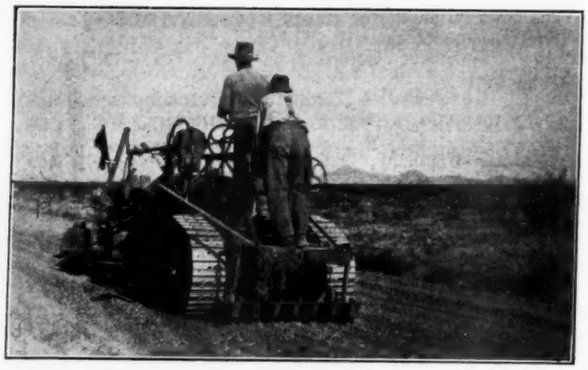
Wash	17.9%
200 mesh	20.8
100 mesh	27.4
80 mesh	30.8
50 mesh	37.3
40 mesh	43.4
30 mesh	50.5
20 mesh	65.1
10 mesh	85.3
¼ inch	98.0
½ inch	100.0

The writer wishes to state at this point that he does not consider the above analysis typical of the material finally placed on the road. He would say that the surfacing as placed runs much coarser because of the fact that the contractor eliminated a large percentage of fines. However, it seemed to be the opinion of all connected with the work that the nearer the surfacing approached the above grading the better the results with oil.

DETAILS OF THE WORK

The various operations may be listed as follows:

(1) Scarifying the depth of 3 inches.
(2) Disc-harrowing to level up for oil.
(3) First application of ½ gal. oil per sq. yd.
(4) Disc-harrowing in the oil.
(5) 2nd application of ½ gal. oil per sq. yd.
(6) Disc-harrowing 2nd application.
(7) 3rd application of ½ gal. oil per sq. yd.
(8) Final disc-harrowing.
(9) Mixing with road grader.
(10) "Laying-down" ready for traffic.



OPERATION 1. FINAL SCARIFYING. ROAD READY FOR DISC HARROW TO LEVEL UP BEFORE OILING

SCARIFYING

This is done by two one-man patrol graders with scarifier attachment. These machines are Spears-Wells graders powered with McCormick-Deering engines. The machines are heavier and much more powerful than New Mexico's Wehrs and Hadfield-Penfields. They are of approximately the same class as the Galion Patrol graders with McCormick-Deering engine of which there are a few in use in New Mexico.

The operation of the scarifier can be closely controlled and this control is vital in securing a uniform depth. The object of close control of the scarifier is to avoid breaking through the surfacing into the subgrade; though, due to lack of uniformity in the thickness of the gravel, the scarifier does sometimes break through. Scarifying of this sort is very slow and very hard on the scarifier teeth. A blacksmith and helper are kept busy sharpening even with a supply of some 300 teeth.

The first trip of the scarifier is made along the edge of the surfacing and often one tooth only can be used on this first trip; occasionally it is possible to use three teeth. Scarifying proceeds from the outside toward the center. After the first cut has been made clear across the roadway, more teeth are put in until, on the final cut, a machine can use the full set. These scarifiers have a marked pulverizing action due partly to their being set close together.

In California's development of the process much experimenting was done with different types of steel: however, it was decided that the so-called tool steels and others of patented composition were not sufficiently longer-lived than ordinary plow steel to justify their greater cost. Eight-tenths of a mile is considered a good performance for scarifier teeth on this class of work.

OPERATIONS 2, 4, 6 AND 8. DISC HARROW DRAWN BY 2-TON TRACTOR, HARROWING AFTER OILING

A good feature of this type of scarifier is that, because of its being rigidly attached to the frame of the patrol grader, it does not tend to dip into small depressions, can be adjusted and held to any depth and can be backed up to catch especially hard spots which would not otherwise be caught until the next round trip.

DISC-HARROWING

Immediately following the complete scarification of a section it is disc-harrowed to level up the loosened surfacing preparatory to oiling. This harrow consists of a double set of discs set at an angle with each other, so that one set will throw the material in the opposite direction to the action of the first set. In operation the two sets form a V. The mixing action of this apparatus is very pronounced with a comparatively small expenditure of power, as it is easily pulled by a 2-ton Caterpillar tractor. The harrow used is known as the Towner 9-foot offset disc-harrow. The discs are 22 inches in diameter and of 7 gauge metal. Each harrow has 14 discs.

OILING

Oiling is done with a pressure distributor mounted on a heavy-duty truck. The distributing mechanism is operated from a power take-off which is furnished with the truck on order, since it is not part of the regular equipment. As it is extremely important that an even flow be maintained, only skilled operators are allowed to handle this work. The governor of the truck is so adjusted that when the application is being made at the proper rate, the truck is working at the limit of its governed speed; or, as the operator put it, "working against the governor." The two men operating the distributor are rated by the Gilmore Oil Company as their best men That they have developed exceptional skill is evidenced by the fact that on a section of 17 miles with a theoretical application of 1½ gallons per square yard, a check showed the actual rate to have been 1.3 gallons per square yard.

OPERATIONS 3, 5 AND 7. APPLYING THE OIL, ½ GAL. PER SQUARE YARD EACH TRIP. THREE TRIPS REQUIRED FOR TOTAL APPLICATION

In advance of the oiling, stakes are set a distance of 10 feet from center of roadway to guide the driver of the distributor so that the outside nozzle will throw to the line marked by the stakes.

The rate of application was intended to be 1½ gals. per square yard over a width of 20 feet. For this width there are 11,733 square yards per mile, requiring 17,600 gallons per mile. The distributor tanks hold 1,100 gallons. To cut down the number of turns, which would have been excessive if the full amount of 1½ gallons was put on at one application, it was decided to apply a third of the amount at each application. This works out to a trip-length

of approximately four-tenths of a mile for each tankful, and this was the rule by which the tank operators gauged the application.

DISC-HARROWING FIRST OIL APPLICATION

As soon as the distributor starts over the section to be treated, the disc harrow pulls in behind it and begins mixing the oiled surfacing. It follows the distributor to the end of the freshly-treated section, and then goes back and forth over the section until the tank returns. This is one operation that cannot be overdone. A spring-tooth was also drawn behind the discs but it is believed this implement could be dispensed with.

The second and third oil applications and the subsequent disc-harrowing are carried on as described for the first application.

MIXING WITH ROAD GRADERS

Immediately following the final application of oil and its attendant harrowing, the mixing proper begins.

For this purpose, two patrol-graders of the one-man type follow the discs. The oiled material is

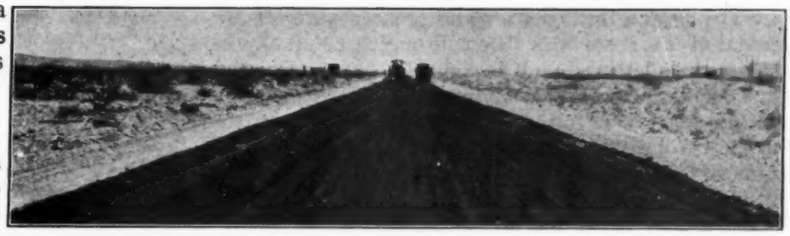
OPERATION 9. MIXING THE TREATED SURFACE WITH ONE-MAN PATROL GRADER. MIX HAS BEEN THROWN TO CENTER FROM LEFT SIDE AND IS BEING BROUGHT IN FROM RIGHT SIDE. THIS OPERATION GIVES THE PROCESS ITS NAME "TURNOVER."

thrown into the center from both sides, forming a long windrow. Then this windrow is gradually worked to one side until it forms another windrow. This shifting is kept up until the material assumes a dark chestnut color. In this operation as many patrol graders are used as may be available; if the graders with scarifier attachment are not busy elsewhere they are put at the mixing.

At this point it should be stated that the faster the blade moves, the better the mixing action because of the better roll given the mix.

"LAYING DOWN" THE ROLL

When the mix has developed the proper color, the small one-man graders are taken off and a 10-ton blade drawn by a "60" Caterpillar tractor spreads the finished material uniformly across the road. The blademan selected for this work is rated as the best the department has



OPERATION 10 COMPLETED. THE MIXED MATERIAL "LAID DOWN" READY FOR TRAFFIC

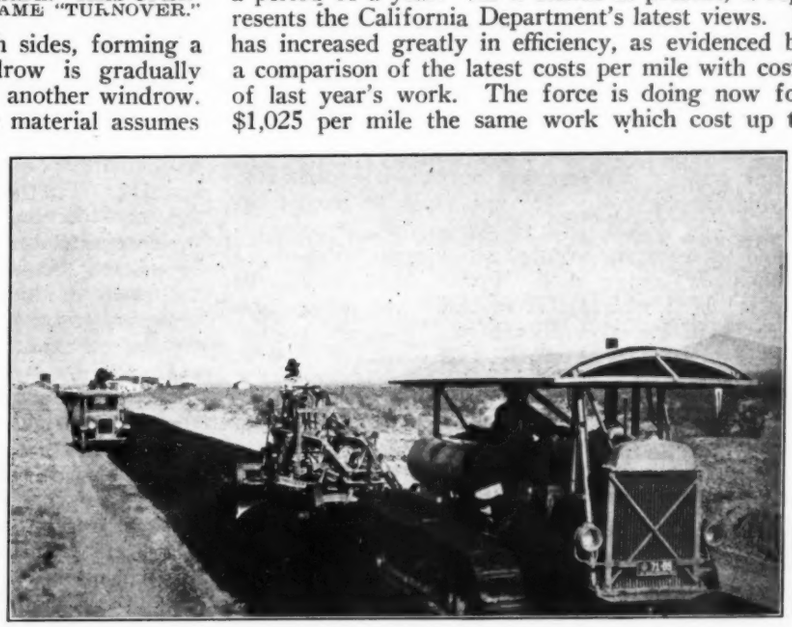
and no one else is allowed to handle this final operation.

When the mix has been "laid down" the road is opened to traffic. (During the work between Barstow and Daggett, traffic used the road at all times, merely switching from one side to the other as the mixing proceeded.)

Immediately after the mix has been "laid down," a 7-foot grader drawn by a small tractor (2-ton Caterpillar or its equivalent) begins working the road behind the traffic for the purpose of keeping the surface smooth during compaction. When traffic first moves over the finished roadway a Ford car will sink into the surface as much as an inch. Within three hours a Ford makes no impression and in three days a 22,000-lb. load will leave only faint marks, which are quickly ironed out by following traffic. The blade is kept steadily working until no further material can be moved, this stage usually being reached about the third day. For this work it is desirable that a rubber-tired tractor be used to avoid cutting up the surface. If such a machine is not available a tractor equipped with street tracks, that is, one with a track composed of flat shoes, will be satisfactory; but in no case should lug wheels or a Caterpillar with grousers or lug shoes be used on the finishing work.

ORGANIZATION

The force doing this work has been built up over a period of a year. As it stands at present, it represents the California Department's latest views. It has increased greatly in efficiency, as evidenced by a comparison of the latest costs per mile with costs of last year's work. The force is doing now for $1,025 per mile the same work which cost up to



OPERATION 10. TEN-FOOT GRADER PULLED BY TRACTOR "LAYING DOWN" THE MIXED MATERIAL

$1,600 per mile last year. The greater part of the reduction in costs has been brought about by a change in methods and machines, the number of men required remaining about the same. It is significant that practically the same crew has been retained throughout the work. This, in Mr. Cash's opinion, has been a large factor in securing the present excellent class of work.

EQUIPMENT

2—One-man patrol graders with scarifier attachments.
3—One-man patrol graders with blades only.
1—Rubber-tired McCormick-Deering tractor.
1—7-ft. grader (used with above tractor for finishing behind traffic.)
1—60-ft. Best Caterpillar pulling 10-ft. blade for "laying down."
1—10-ft. Adams grader (used with the "60").
1—2-ton Caterpillar pulling disc-harrow.
1—Graham 1½-ton truck for servicing.
2—Ford roadsters with pick-up bodies, (1 for foreman, 1 for timekeeper).
1—Offset disc-harrow.
1—Spring-tooth harrow.
1—Set blacksmith equipment.

CREW

1—Foreman.
1—Timekeeper.
1—Truck driver.
1—Blademan operating 10-ft. blade.
6—Blademen operating 7-ft. blades.
1—"60" Runner.
2—2-ton Runners.
1—Blacksmith.
1—Blacksmith helper.
3—Laborers.

The above crew is the regular State force. The Gilmore Oil Company furnishes the distributing equipment, pays the operators, handles all demurrage and heating of oil, for the contract price per gallon of oil applied to the road. This price varies with the length of haul; hauling from Daggett west, the price was 3.77 cents per gallon.

COST

The cost per mile has steadily decreased, but had about reached bedrock on June 2nd, when it was given as $1,025 per mile, with oil at 3.77c per gallon.

The cost of the separate operations—scarifying, mixing, laying-down—are not available except indirectly. The cost of applying oil may be approximated by using the average actual application of 1.3 gallons per square yard. For a 20-ft. width, the cost is: 11733x1.3x.0377, say $575 per mile. This leaves $450 for other operations.

This $450 is roughly used as follows:

Labor	$186 per mile
Equipment rental	120 per mile
Gas, Oil and Supplies	144 per mile

In this connection it might be of interest to note the equipment charges against the machines used:

Equipment Rentals

Charges per day against:

"60" Caterpillar	$16.00
Spears-Wells patrol-grader with scarifier	7.00
Spears-Wells patrol-grader with blades only	4.70
Galion patrol-grader with blades only	5.50
McCormick-Deering tractor	3.75
1½ Ton Graham truck	5.00
Ford roadster (pick-up body)	2.00
10 ft. Adams grader	1.50

Charges which are difficult to allocate to any particular item of the work constitute a surprisingly large amount; for instance on 23.6 miles of the "turnover" work these charges totaled $3,043; this included gas, oil, heavy hardware, disc-harrows, spring-tooth harrows and grader blades. The item for grader blades alone was $700.

THE OIL

The oil used for the "turnover" process is what is termed "Medium Road Oil"; it is of approximately 14 gravity and is delivered to the work in practically the condition in which it comes from the well; in fact the only treatment to which it has been subjected is an electrolytic process for removal of water. It is generally referred to by the engineers as 65 per cent oil, meaning its content of 80 penetration asphalt.

THE FINISHED ROAD

Vialog tests on the finished road demonstrate it to be smoother than any other type of road on the California highway system, and this includes concrete, asphaltic concrete, and bituminous macadam.

The writer rode over sections of this type of road which have been in service for 9 months under an average traffic of 600 cars per day (passenger and light trucks). No wear was apparent; no rutting had taken place.

Here and there over the completed 26 miles, one would observe streaks of very light-colored material showing a raveling action. This indicates a too lean mix. The remedy, when the condition is present only in isolated spots, is to dig out the lean material and replace it with a mix of proper consistency taken from stock piles.

Along other sections a very dark surface appears along the lane of heaviest traffic. This indicates a mix too rich in oil—too "fat" is the usual term. There are more sections of this type than of the "lean" type, indicating that the first construction tended toward a rich mix. These sections usually occur in fairly long stretches. The remedy is to scarify and remix. For this purpose they use a one-man machine with scarifier attachment operated by one of their most experienced men. This operator will scarify, remix and "lay down" about 1,000 feet per day. The process is practically identical with new construction. It is a job calling for much experience, including a fine discrimination for color because of the fact that considerably less than one-half inch of additional dry material is all that is necessary to bring the mix to the proper consistency. As the color and consistency of the final mix cannot very well be determined until the whole mass has been laid down, it is evident that an inexperienced man could easily make this operation a very costly one.

Should error in judgment have produced too lean a mix, the only remedy is to bring up the oil distributor and apply 1-8 gallon per sq. yd. This application is then covered by shoulder material. The department now inclines toward a mix so lean that it will ravel. It is then sealed with 1-8 gallon per sq. yd., following with a cover of shoulder material. The amount of oil will not be materially reduced

but a thicker cake will be formed and "bleeding" will be eliminated.

MAINTENANCE

Maintenance to date has consisted only in remedying construction defects as noted above. On those sections where a uniformly dark chestnut color was obtained at the start there has been no charge for maintenance.

CHANGE IN CONSTRUCTION PRACTICE

It is of interest to note that construction practice has changed somewhat even in the short time of a month. Compare practice as outlined April 28, 1927, with the methods the writer found in effect June 2:

April 28: "This loosened surfacing is thoroughly bladed from one side of the road to the other and back again. This operation uniformly mixes the gravel with the filler and also produces a surface without irregularities."

June 2. The writer finds that this preliminary blading has been abandoned for the reason that the same result is gotten a little later by the same method *after the oil has been applied*. Result: a lowering of costs without lowering quality of finished product.

April 28. Clean sand required as a filler for the seal coat. Brought in by truck and applied by hand. Expensive.

June 2. Shoulder material found to be a satisfactory filler; is spread by graders. Another cut in costs.

A FINISHED ROAD. 1926 WORK

These changes in practice, all tending to lower costs, have been going on for a year. It speaks much for the open-mindedness and willingness to learn on the part of the men engaged in the work.

As the experiment stands now California feels that it is a success, but it is not claimed to have reached the ultimate, either in methods or costs.

CONCLUSIONS

It is the writer's opinion that the "turnover" or mixing method can be applied successfully to New Mexico gravel roads. Because of varying types of surfacing material, each road will present a problem of its own, to be carefuly studied and a locally suitable treatment devised. *The determining factor in each case will be the amount and character of the fines, that is, the portion passing the ¼ inch screen.* On a surface the fines of which are composed of disintegrated igneous rock, a thicker cake can be built up than on a surface composed of limestone, which tends to reduce to a powder rather than a sand. The same amount of oil will produce a thinner cake, also, where the binding material of the original surfacing is a clay, caliche or adobe, because of the greater absorptive qualities of the powdery binder.

It must be borne in mind that California has attained excellent results and low costs only after much experimentation and through the development of a trained force—an organization, in fact, which has done only this one thing since the work began. Should New Mexico adopt this method, it is certainly advisable that we also train a crew, drawn from the best of our maintenance forces, and, having trained them, entrust the handling of this type of work to this force only.

Survey of California Bridges

Last spring the California State Highway Commission directed the state highway engineer to investigate and report on all the bridges of the state highway system, regarding their load-bearing capacity and general physical condition, and to post with adequate warning signs those bridges found to be in a weakened condition. The Bridge Department assigned two of its experienced assistant bridge engineers to the task, one to the southern and one to the northern part of the state. C. E. Andrew, bridge engineer for the commission, stated that these engineers were instructed to examine first those structures which were known to be dangerous and were already posted for low-limiting loads so that the load limit signs then existing might be either revised or eliminated.

There are over 600 bridges of various types and design on the state highway system, many of them in a dangerous condition structurally, while others are depreciating so rapidly that they will soon be dangerous, and still others will be safe for ordinarily heavy loads for many years if they are not over-stressed.

The complete survey is expected to serve many purposes; to establish the load capacity of all bridges both for continuous traffic which may be hauled without permit and for intermittent loading which may be permitted occasionally under special permit; to determine the traffic-carrying capacity, width of roadway, and condition and alignment of approaches; to find which bridges require immediate replacement and which may be adequate for a few years or those which may safely carry the traffic for a number of years; also to learn which structures, while immediately dangerous, may be repaired with a nominal expense and made adequate for the immediate future.

Providence Traffic Marker

Providence, Rhode Island, still uses the old fashioned kerosene lantern as a light in connection with its traffic signals or markers, because of certain advantages which it thinks that they still retain over the electric or gasoline light.

D. K. Finley, manager of the Providence Safety Council, points out that it oftens becomes necessary to change the locations of traffic lights to remedy a temporary change in the flow of traffic and this can be done with the lanterns without trouble or expense. They are also useful in experimenting in the

location of traffic signals. Another argument is the low up-keep cost, the police taking care of the lanterns. The lantern markers are of three distinct types; one is used to designate the routine direction in which traffic shall proceed; another carries a green lantern at night to permit the movement of traffic in accordance with instructions; and the third has two red lanterns which are used in designating loading areas.

Where only one lantern is used, it is fastened on the top of a vertical post set in a heavy flat iron base. Where two lanterns are used, a steel rod is fastened horizontally to the top of this post, each end of the rod being bent into a hook on which a lantern is suspended.

Minocqua Timber Highway Bridge

The Wisconsin Highway Commission has recently completed a bridge (a Federal Aid project) over Lake Minocqua on U. S. Highway No. 51, which replaces an untreated timber pile trestle about 850 feet long with a 16-foot roadway built in 1912. The water here is about 25 feet deep near the center of the bridge, with about 10 feet of muck and soft sand over firm bottom. The roadway at the center of the bridge is about 12 feet above water.

The new structure was built of creosoted Douglas fir timber on piles of yellow pine. All piles and the 12x12, 10x12 and 6x16 timbers were treated with not less than 14 lbs. of oil per cubic foot; other timber and lumber with not less than 12 lbs.

There are fifty-four spans with bents 15 ft. centers and one 21 ft. span at the center for passage of boats; the roadway being higher at the center than at the ends for the same purpose. The roadway is 27 ft. clear between curbs, and there is a 5 ft. sidewalk on each side. Each bent was made of eight piles, double cross braced, surmounted by a 10x12 cap. The piles were 30 to 60 feet long, mostly the latter. The head of each pile, after being cut off to grade to receive the cap, was treated with hot creosote oil and covered with a sheet of No. 12 zinc. All the structure except the roadway wearing surface were built during the winter, and the piles were all driven from the ice.

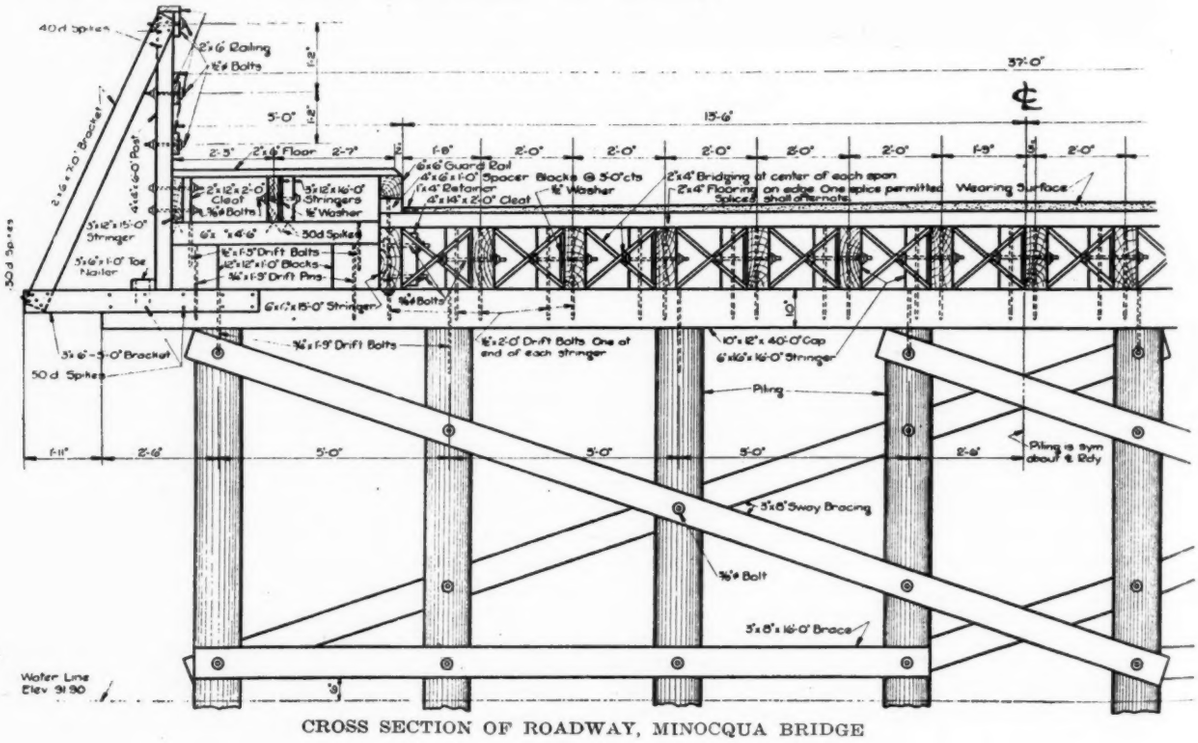
The railing consists of 4x4 posts with 2x6 rails. Roadway joists are 6x6 timbers. The floor is of the laminated type of 2 by 4's on edge, spiked together, on which was placed a tar wearing surface.

Of ten bids submitted, the lowest, which was awarded the contract, was $58,783.20.

Standardization of Hose Coupling Threads

About forty percent of the total number of fire-protected cities and towns in the United States have adopted and put into use the National (American) standard for screw threads for fire-hose couplings and at the present time the process of converting the existing equipment to the standard dimensions is well organized in twenty-four states.

This standard deals with the threaded parts of couplings from 2 1-2 to 4 1-2 inches and applies to the larger sizes of hose couplings used on fire lines outside and inside office and factory buildings. A further step has now been taken, according to an announcement made by the American Engineering Standards Committee, with the recent appointment of a representative special committee in regard to the proposed establishment of standards for small hose couplings, which would complete this important piece of standardization work, extending it to sizes from ½ to 2 inches, as used in factories and office buildings.



CROSS SECTION OF ROADWAY, MINOCQUA BRIDGE

Two requests bearing on the subject of standardizing the smaller sizes of screw threads for hose couplings have been officially presented to the American Engineering Standards Committee; one from the National Fire Protection Association and the other from the American Society of Mechanical Engineers. There are important differences, relating to the fineness of thread recommended and its consequent ability to withstand rough usage, between the recommendations of the Fire Protection Association and those of the National Screw Thread Commission. Under the procedure of the A. E. S. C. it will be possible to bring these conflicting interests into a common forum and work out a set of standards which will, it is expected, unify the hose coupling field and avoid undesirable and costly differences in practice. Cloyd M. Chapman is chairman of the special committee which has been appointed to advise the A. E. S. C. in connection with the proposed unification. The bodies represented on this committee are: A. E. S. C. Fire Protection Group; American Mining Congress; American Petroleum Institute; American Railway Association; American Society of Mechanical Engineers; International Association of Fire Engineers; Manufacturers Standardization Society of the Valves and Fittings Industry; National Screw Thread Commission; Railway Fire Protection Association.

New England Water Works Convention

Papers read and discussions of them, and business transacted at the forty-sixth annual convention. Excellent discussion of most of the papers and an interesting Superintendents' Conference

The 46th annual convention of the New England Water Works Association, held at the Hotel Statler, Boston, September 13-16, was attended by about 225 active members and 125 associate members, there being registered also about 230 guests. Eight sessions were held for the reading and discussion of papers and these were all fairly well attended. The number of papers on the program had been intentionally limited so as to give time for discussion, and in the majority of cases the opportunity was taken advantage of by a number of members. The most interesting discussions, at what appeared to be the most interesting meeting of the convention, was the special superintendents' conference held on Wednesday evening, at which about 75 superintendents were present.

Mayor Malcolm E. Nichols had offered a trophy for the member coming the longest distance to attend the convention and this went to Charles S. Denman of Des Moines.

As usual, there was an exhibition of mains, service pipes, meters, and other appliances used in connection with water works, which were attractively displayed in a hall adjoining the conference hall. One of the interesting features here was a working model of the Barber-Greene trench digger which was complete in all details and was operated electrically. A list of exhibitors was published in PUBLIC WORKS last month.

The finance committee, Samuel E. Killam, chairman, reported recommending a budget of $10,000 for the year 1927-28, which was a few hundred dollars more than for the previous year; which budget was adopted by the convention. The committee also recommended that about $2,000 balance in the treasury be invested in securities. At the last session of the convention, on Friday morning, the tellers of election announced the following officers elected for the ensuing year: President, George A. Carpenter; vice-president, Robert Spurr Weston; directors, George C. Brehm and Roger W. Esty; treasurer, Albert L. Sawyer.

On Thursday morning the announcement was made of the award of the Dexter Brackett Medal to C. M. Saville for his paper on "Compensating Reservoirs, and the Diversion of Water."

NARRATIVE OF THE CONVENTION

On Tuesday morning, following preliminary addresses, Frank A. McInnes reported as chairman of the committees on Standardization of Cast Iron Pipe and Special Castings, Simplification of Manhole Frames and Covers, Specifications for Cast Iron Pipe and Special Castings, and Standardization of Pipe Flanges and Fittings. In connection with the standardization and specifications of cast-iron pipe and special fittings, he stated that specifications for several sizes had been adopted and others submitted to the Am. Engineering Standards Committee and that investigations would be continued, at least $22,000 having been provided for them and more than 30 societies and manufacturing companies being interested in them.

E. Sherman Chase, chairman of the Committee on System of Sanitary Scoring of Water Supplies, presented a score system in which the items affecting the quality of water supplies were classified under the three heads of pollution hazard, protective measures and quality conditions. This score system is published elsewhere in this issue. The committee had submitted a progress report in 1926 and the system presented this year was recommended for adoption. It had been preceded with corre-

spondence with State health boards and engineers and superintendents of water works, who had sent numerous suggestions and criticisms. The aim of the system is to give numerical values to water supplies on a basis of sanitary acceptability. A resolution was adopted recommending that cards for recording scores on this system be printed and sold by the society.

Progress reports were submitted by the committees on Painting Standpipes, Yields of Catchment Areas, Effect of Cement Lined Pipe on Quality of Water; while the Legislative Committee reported that there had been no legislation of interest to water works men in Massachusetts during the past year.

In the afternoon, following the reading of papers on Water Supplies in New York State and Laws Relating Thereto, by C. A. Holmquist, on Cross Connections in Connecticut, by Warren J. Scott, and the report of the committee on Cross Connections, Robert S. Weston, chairman, there was considerable discussion on the latter question. Mr. Weston stated that all of the members of the committee could not agree on all points, especially on whether the double check valve should be permitted and if so under what conditions. Mr. Sherman believed the double check valve to be much safer than the single and quite reliable if the valves were inspected regularly, but the objection is that there might be, and undoubtedly in some cities is, failure to so inspect them. Replying to a question concerning the use of an alarm between the check valves, C. W. Mowry replied that the idea had been considered about fifteen years ago but abandoned. He stated that in New Bedford the check valves were opened, inspected and cleaned annually. One member told of ammonia from an ice plant getting back into the mains and another told how, where a compound meter had been installed, the smaller meter was made to run backward by leakage through the check valve. Mr. Scott stated that in Connecticut the manufacturers had agreed voluntarily to cut out cross connections on proof that they were dangerous, and thousands of dollars had already been spent in this work.

Discussing the subject Leaks and Litigation, George H. Finneran spoke chiefly concerning leaks. Among other things he stated that in a large city like Boston it is difficult to locate leaks by any of the listening machines because of the many other noises in the street. Some of the largest leaks have been found in the form of blow-offs. Leaks in stuffing boxes of valves were found to be especially difficult to remedy. Submarine leaks have been located by forcing compressed air into the pipe and watching for bubbles on the surface of the water. From the legal point of view, the Massachusetts courts held that a city could not free itself from liability for damages caused by leaks on the plea that providing water is a governmental function; such plea having foundation only where the water is furnished solely for fire protection or other public service for which the city received no compensation.

Last year a committee with P. R. Sanders as chairman had been asked to investigate the use of thermit in thawing frozen hydrants. Mr. Sanders reported that they had experimented with the use of a thermit torch on the outside of a hydrant, and where the hydrant was only partly frozen they finally succeeded in thawing it; but where the hydrant had been entirely frozen up, the torch was not successful although continued for a long time and although the hydrant was heated to a red heat where the torch was applied. The committee will continue trials of the torch this year.

Tuesday evening and the early part of Wednesday morning were devoted to fire protection papers and discussions. The papers read were: Fighting Fires Beforehand, by Charles W. Mowry; Field Engineering Service of the National Fire Protection Association, by Franklin H. Wentworth; Reliability Features of Electrically Operated Pumping Equipment, by R. C. Dennett; and Five Years' Operation of Boston High Pressure Water System, by E. E. Williamson. Mr. Mowry, in his paper described the work done by the Inspection Bureau of the Associated Factory Mutual Fire Insurance Company (of which he is assistant manager) in having factories take such precautions, as by introducing physical features, insuring frequent inspections, etc., as would tend to prevent fires. Franklin H. Wentworth described the work done by the National Fire Protection Association, of which he is secretary, in organizing the country for the prevention of fires, securing the adoption of fire prevention week, persuading cities to conduct local fire prevention campaigns, etc.

Mr. Dennett in his paper considered not only electrically operated pumping equipment but also gas, gasoline and Diesel. While electrically operated pumps are perhaps the least reliable against occasional interruption of service, the possibility of such interruption can be made very remote. Mr. Hazen referred to the desirability of elevated tanks to carry the fire loads should the pumps be out of service for a short time, and expressed preference for induction motors to synchronous motors where the load is variable, although where it is constant the synchronous motors were more economical. Mr. Nolan said that steam for a reserve pumping plant it unsatisfactory, since it is too difficult to keep it in readiness for instant service and it takes 10 or 12 hours to start up a steam plant if sufficient time is taken to heat the boiler without endangering it. In Chicago, some Diesel reserves had been found more economical than electricity. E. E. Williamson described quite fully Boston's high-pressure water system which, he stated, was started on an average of 414 times a year. 125 pounds is maintained in the system and more can be furnished if asked for. This high-pressure service draws water from either of two regular services or may draw salt water from the harbor. The last has never yet been used. There are two stations, with two men at each during each of three 8-hour shifts. Only one station is operated unless it finds it difficult to maintain 125 pounds pressure, when it 'phones to the other station to supplement it. There are two 3000 gallon pumps in each station. The hydrants average 150 feet apart. The stations are under the Fire Department but the mains and hydrants are under the Public Works Department. The first engines to reach a fire connect to the old domestic service hydrants and remain as reserves, but most of the fire fighting is done with

the high pressure system. Special pains was taken with the joints of the mains in laying the system, the joining material used being 95% lead and 5% tin. In testing, a leakage of 2 gallons per lineal foot of joint per 24 hours was allowed, but the joints were really believed to be absolutely tight, the 2 gallons allowed being leakage through valves which could not be shut absolutely tight. The mains were tested to 450 pounds and not a joint started during the test. When the mains were three years old the pumps maintained 350 pounds at the mains for 15 minutes, with no leaks.

Wednesday afternoon's session was to have opened with a paper on the Montreal Typhoid Epidemic, but this paper had been suppressed by the officials of that city, in line with what has appeared to be their settled policy. Two papers were then read, one by C. M. Saville on Interstate Water Rights, and one prepared by Clemens Herschel and read by the secretary, on Public Works and State Boundaries. Mr. Saville considered both the engineering and legal phases of the subject of Interstate Water Rights, these including not only the right to a certain quantity of water, but also the right to have this in a reasonably unpolluted condition; which involves the passing on from the upper to the lower state of a sufficient quantity of water to satisfactorily dilute the sewage which was contributed to the stream by the upper state. Reference was made to the proposal of Boston to divert water from the Connecticut river for its own use, Mr. Saville maintaining that a sufficient dilution of the sewage contributed by Massachusett cities required that there be maintained in the river below the Boston intake at least 1.5 cubic feet per second per square mile of river flow. Concerning the tri-state treaty between Pennsylvania, New York and New Jersey, which treaty has failed of endorsement by two of the states, J. Waldo Smith stated that New Jersey's refusal was political, M. N. Baker stating that the light and power interests of New Jersey were the concealed power behind the opposition. In the discussion, Mr. Hazen called attention to the fact that the Spanish laws on water rights which prevail in the Southwest are entirely different from the English laws which obtain in the Eastern part of the United States. Mr. Herschel's paper dealt largely with the legal and engineering difficulties of utilizing in one state water in streams which arose in another state, especially when it was desirable to build reservoirs in the latter. Mr. Weston suggested that cities could form semi-public corporations and as such purchase land in the foreign states and thus acquire riparian rights.

Two papers were then read by representatives of commercial interests, one by R. V. Donnelly, of the Paradon Mfg. Company, entitled "What Every Engineer and Water Works Superintendent Should Know About Chlorination;" the other by F. R. McCrumb of the La Motte Chemical Products Company, entitled "Elimination of Errors in the Ortho-Tolidine Method."

The Superintendents' conference, which was held coincident with a main conference on Wednesday evening, was in charge of Stephen H. Taylor as chairman. The first question discussed was as to the necessity or desirability of laying two mains on wide streets, one on each side. One speaker suggested that economy of this construction depends upon the number of houses that would probably be built on the opposite side of the street. Another stated that where he had laid two mains, one smaller than the other, he found trouble in keeping the smaller main clear of deposits, there being 22 consumers in 1600 feet of this main. There seemed to be a general agreement that no width of pavement could be named which would determine when the two lines of mains were preferable to one, there being so many local conditions affecting the problem, including the kind of pavement to be laid, the number of residences on each side of the road, etc.

The practice of providing pre-services, or services laid prior to street improvements and before there would be any need for such services, brought out the apparently unanimous opinion that such construction was not desirable and that no city could enforce it although many of them bluffed it through. There seemed to be a general agreement that not 10% of these services were ever used in the future and a number of superintendents cited instances where none of them could be used and they were only a waste of money and a possible source of leakage.

A number of superintendents told of their own practices in connection with flushing mains—the method, the season of the year, the time of day, etc. Some of them flushed at night and some flushed in the day time, some flushed spring and fall and others seemed to have no set season. The same was true of fire hydrants; some were inspected once a year, some after each fire; some by the Water Department and a few by the Fire Department.

The discussions brought out dozens of interesting little incidents; for instance, several instances of the breaking of mains by lightning were referred to, but only one of these was cast iron while quite a number of mains of the old type cement-lined construction had been so struck. Concerning cleaning mains, one stated that his cement lined mains never required cleaning while the cast iron mains required frequent cleaning. Secretary Gifford, stated that in Dedham he had found an 8" pipe near the pumping station reduced to about 4" diameter by sediment which had apparently been sucked in through the wells, all of the water used being from wells. Several opinions concerning the color to be used in painting hydrants were brought out. One superintendent stated that orange colored tops were visible to autoists, another used vermillion ground in varnish and in other cases aluminum ground in varnish. It was brought out that it was fully as desirable in connection with visibility, to bear in mind automobilists as firemen, Secretary Gifford in fact stating that firemen ought to know where the fire hydrants were without having to have them painted specially for their benefit. Interesting and valuable facts and opinions were brought out concerning inspection of valves, the kind of pipe used for services and why, and the life of the various kinds.

Meantime, at the main conference, G. A. Sampson had presented a paper describing the Amesbury Iron Removal Plant; Myron G. Mansfield described Sand Embankment Impounding Dam at Chicopee;

and Abel Wolman discussed Municipal Water and Sewerage Costs in the State of Maryland.

The Amesbury iron removal plant utilized aeration through perforated caps, coke filters 18 ft. deep, and slow sand filters.

The sand embankment dam described by Mr. Mansfield was located on sand, gravel and clay soil and watertightness secured by a thin reinforced concrete wall and sheetpiling.

Mr. Wolman illustrated the advantages of a rational plan for financing the construction and annual costs of water and sewerage systems, which plan has been used in Maryland.

On Thursday morning, A. O. Doane described in minute detail the distribution pumping stations and pumping machinery of the Metropolitan Water Works. Concerning the replacement of old pumps, Mr. Doane said that triple expansion would be too expensive for new pumps, a 20,000 million gallon per day pump now costing $175,000 to $220,000. He considered steam turbine as best theoretically, but the skill required, the gearing, etc. offset this to a considerable extent. The cross-compound pump holds its duty well and is easy to run and is apparently favored by him. Above 20,000 gallons per day the steam turbine is considered the only thing, although the electric pumps must be considered if they are properly safeguarded against interruption of service. Steam remains the most dependable pump. W. W. Brush said that New York City is putting in as stand-bys gasoline for 5,000,000 gallons per day, but may use electricity in the future. The city is generally abandoning steam, although it is admitted that steam is the most reliable for continuity of service. However, electric pumps have been operated in New York for 20 years without any interruption of service, there being a penalty of $500 per minute for any such interruption. The price paid by New York for current is from 1 cent to 1.2 cents per k.w.h. Mr. Doane said the Diesels develop very high duty but were also high in first cost.

Thorndike Saville described problems encountered in designing an enlarged water supply for Caracas, Venezuela, and the methods of solving some of the problems, these being illustrated with lantern slides showing features of the Caracas system. J. B. Gibson described the standpipe at Charleston, S. C., (see Public Works for August, 1927). Melville E. Whipple and Harold C. Chandler had jointly prepared a paper, which was read by Mr. Whipple, entitled "Five Years of Rapid Sand Filtration at Cambridge, Massachusetts." This was followed by another paper by Julius W. Bugbee describing One Year's Operation of the Providence Filtration Plant.

In discussing the operation of the Cambridge plant, Mr. Whipple said that recently sodium aluminate had been used together with sulphate of alumina with a view to reducing the cost. Instead, the cost of alumina increased somewhat but that of soda ash was reduced.

At Providence, filter washing is confined to the day shift, only one man being on duty the other 16 hours.

Friday morning Wm. W. Brush, in a paper entitled "Clarification of the Catskill Water Supply by Coagulation and Sedimentation," stated that clarification had not been necessary until Schoharie water was delivered into the Ashokan reservoir, in 1926.

From November until May, 1927 alum and soda ash were used. The latter was used to prevent red water, and its use may be continued for that purpose as standard treatment. The cost of this treatment for six months was $220,000.

The convention concluded with the reading of the president's address, which was largely historical, by title only, as time was limited.

Sanitary Scoring of Water Supplies

At the September convention of the New England Water Works Association the Committee on System of Sanitary Scoring of Water Supplies presented a form for scoring which was adopted by vote of the convention. This had been submitted to the State health departments and a number of waterworks superintendents for criticism, as a result of which the committee had revised somewhat the system as presented tentatively a year previous.

"The object of the score system is to list the many sanitary dangers, the several protective measures, and the desirable qualities of the water delivered. The assignment of numerical penalties and credits is for the purpose of indicating relative values in an approximately quantitative way. The committee does not pretend that the values given are the best that can be selected, nor that they are exact, but it does believe that the values are relatively reasonable."

To a criticism that, having scored a supply, it is necessary to go back to the detailed description to learn the reason for low score, the committee considers this an advantage, as the real object of the scoring is to produce a betterment of objectionable conditions. It does not recommend scores for publicly comparing different supplies, but to bring to the attention of officials the necessity of certain improvements and their relative importance, and to enable a superintendent to prepare a balance sheet of the sanitary assets and liabilities of his supply.

To the criticism that a city should not be penalized because it has to take its supply from a polluted source, the reply was made that the danger is as great whether so obtained through choice or necessity.

The committee consisted of E. Sherman Chase, chairman, J. Frederick Jackson and Arthur D. Weston.

OUTLINE OF SCORE SYSTEM.

SURFACE SUPPLIES

(Main Group.)

I. *Pollution Hazards*:	
Score for no hazard	60
Hazards connected with Sources of Supply:	
1. Population on watershed (p = population per sq. mile of watershed):*	
a. Contributing indirect pollution and where sewage is diverted from watershed	$-2\sqrt{P}$
b. Contributing direct pollution (sewage)	$-8\sqrt{P}$
2. Highways and railroads (per linear mile per sq. mile of watershed)†	—1

*Zone large watersheds in 50-mile stretches by dividing by $\sqrt{d}$, where d = some multiple of 50 miles.

3. Lumbering, labor camps, hunting, etc.:†
   a. Lumbering, labor camps, etc..... —2
   b. Hunting, picnicking, etc..... —1
4. Animal pollution:†
   a. Direct ..... —2
   b. Indirect ..... —1
5. Industrial wastes .....—1 to—5
6. Leaky intake, suction main or gravity main from relatively unpolluted source passing through sewage-polluted water.....—25 to—60

Hazards connected with Storage and Distribution of Supply:

7. Fishing, boating, ice-cutting, bathing, etc., on distribution or small-storage reservoirs:
   a. Fishing and boating.....—2 to—25
   b. Ice-cutting:
      Ice house at reservoir..... —2
      Ice house away from reservoirs —1
   c. Bathing ..... —5
8. Accessible distribution reservoirs:
   a. Open and unprotected..... —5
   b. Open but protected by locked fence, etc. ..... —2
9. Inadequate protection against polluted water leaking into pure-water reservoirs, e.g., double-storage tanks, one part for safe and other for unsafe water; leaky raw-water conduits passing through clear-water basins, etc.....—5 to—60
10. Cross-connections with polluted supplies:
   a. Single or no check valve should not be tolerated .....—15 to—60
   b. Double-check, F. M. type, regularly inspected ..... —5
11. Dual water-supply systems, one from a safe source and the other, for emergency use, from a sewage-polluted source.....—10 to—60
12. Inadequate pressure and storage.... —10

Miscellaneous Hazards (unlisted). Penalize according to judgment.

II. *Protective Measures*:

Total score not to exceed..... 30

1. Sewage and industrial wastes treatment divide score for direct pollution hazard and industrial wastes sewage according to extent of treatment, as follows:
   a. Sedimentation, divide by 2.
   b. Complete treatment without disinfection, divide by 3.
   c. Complete treatment with disinfection, divide by 4.
2. Proper sanitary regulation, patrol, and enforcement 4
3. Ownership of watershed, 100%..... 5
   (For less than 100%, pro-rate according to area owned.)
4. Storage (minimum):
   a. One month or more..... 10
   b. Two weeks 5
5. Water Purification:
   a. Chlorination 10
   b. Pressure mechanical filters:
      with coagulation basin..... 10
      without coagulation basin..... 5
   c. Gravity mechanical filters..... 15
   d. Slow sand filters..... 15
   e. Copper sulphate treatment, aeration, etc., for algœ..... 5
   (For combinations of the above purification methods, add individual scores, total credited not to exceed 30.)*

Penalties for Failure or Inadequacy of Protective Measures:

1. Improper operation of sewage and industrial wastes treatment plants —allow no credit.
2. Lax enforcement of sanitary regulations, improper or inadequate regulations, irregular patrol or none .....—2 to—4
3. Short circuits in storage reservoirs —5
4. Improper operation of purification plants (not to exceed credit for plant):
   a. Inadequate dosage of chlorine.... —10
   b. Intermittent operation of chlorination apparatus, absence of duplicate equipment, etc..... —5
   c. No coagulant with mechanical filters ..... —10
   d. Exhaustion of chemicals or chemicals of poor quality..... —5
   e Filters in poor condition..... —5
   f. Combustible buildings housing essential equipment ..... —5
5. No or inadequate laboratory control of water quality..... —5
6. Incompetent or untrained filter operator ..... —5

III. *Quality Conditions*:

Total score not to exceed..... 30

Turbidity:†
   Clear 2
   0 to 5 p.p.m..... 1
   Over 5 p.p.m..... 0

Color:†
   Colorless 2
   0 to 10 p.p m..... 1
   Over 10 p.p.m..... 0

Odor:†
   None 2
   Penalty for bad odors up to..... —5

Taste:*
   None 2
   Penalty for bad taste up to ..... —5

Hardness:*
   Under 50 p.p.m..... 1

Corrosiveness:*
   None 1

Iron and manganese:*
   Less than 0.5 p.p.m..... 1
   Penalty for excess of 1 p.p.m..... —3

Total bacterial counts on agar at 37° C.—24 hrs:*
   Less than 100 c.c..... 5
   Over 100 per c.c..... 0

B. coli type:
   Absent in 100% of 10 c.c. inoculations 20
   (Present in part of 10 c.c. inoculations, pro-rate according to per cent. of samples positive.)

Note: Total score not to exceed 100.

SURFACE SUPPLIES

(Sub-group: Great Lakes, connecting rivers and St. Lawrence River.)

I. *Pollution Hazards*:

Score for no hazard..... 60

Population within two weeks' maximum velocity time of flow above intake in case of river, or within 30 miles of intake in case of Great Lakes (p = population 1,000)
   a. Contributing indirect pollution.. $-\frac{1}{2}\sqrt{p}$
   b. Contributing direct pollution.. $-2\sqrt{p}$
   (Other pollution hazards score, where applicable, the same as for main group.)

II. *Protective Measures*:

Same as for main group.

*Except that excess credits may go to offset penalties upon protective measures and a maximum credit of 35 may be allowed with double filtration.
†2, 3 and 4. Applied only when population is less than 100 per sq. mile.

*Sum of credits not to exceed 10.
†Sum of credits not to exceed 10.

III. *Quality Conditions*:
Same as for main group.

GROUND WATER SUPPLIES
(Main group: depth less than 200 ft.†)

I. *Pollution Hazards*:	
Score for no hazard	60
1. Population (p = population):	
a. Between radius of 300 ft. and 1,000 ft.	$-\sqrt{P}$
b. Within radius of 300 ft.	$-7\sqrt{P}$
2. Sewers, cesspools, etc., within 300 ft.	—10
3. Improperly protected top	—5
4. Leaky casings	—5
5. Connections with polluted surface water	—10 to—60
6. Flooding within 300 ft. by sewage-polluted surface water	—5
7. Distribution hazards: The same as for surface supplies.	
II. *Protective Measures*:	
Total score not to exceed	30
1. Depth and kind of strata penetrated:	
Sand under 20 ft. in depth	5
Sand over 20 ft. in depth	15
Sand and gravel under 20 ft. in depth	3
Sand and gravel over 20 ft. in depth	10
Seamy rock and limestone	0
Impervious layer above water-bearing stratum	10
2. Purification methods: Credits and penalties the same as for surface supplies.	
III. *Quality Conditions*: The same as for surface supplies.	

GROUND WATER SUPPLIES
(Sub-group: depth more than 200 ft.*)

I. *Pollution Hazards*:	
Score for no hazard	60
1. Population (p = population):	
a. Within a radius of 1,000 ft.	$-2\sqrt{P}$
(Other pollution hazards the same as for main group.)	
II. *Protective Measures*:	
Total score not to exceed	30
1. Overlying soil: Same as for main group.	
2. Purification methods: Credits and penalties the same as for surface supplies.	
III. *Quality Condition*: The same as for surface supplies.	

*"Depth" means depth of tight casing.
†"Depth" means depth of tight casing.

Projects of American Engineering Standards Committee

The American Engineering Standards Committee has published its annual year book for 1927 which has been revised to May 1st of this year. Among other contents of this report is a list of the standardization projects which have official status before the committee, with the stage of developments reached by each project. Among the more than 200 projects, those which are of special interest to engineers on public works include the following:

"Approved" by the Committee and issued we find tests for toughness of rock; specifications for drain tile; method for distillation of bituminous materials suitable for road treatment; method of test for penetration of bituminous materials, method of test for unit weight of aggregate for concrete; method of test for voids in fine aggregate for concrete; method of test for organic impurities in sand for concrete; sampling stone, slag, gravel, sand and stone blocks; test of apparent specific gravity of coarse aggregate; cement grout filler for brick and stone pavements; specifications for block for granite block pavements; spiral steel rods for concrete reinforcement; and screw thread for fire hose couplings. The committee has under consideration a draft proposal for specifications and tests for portland cement; rating of rivers, and a safety code for industrial sanitation. Standardization work is under way for specifications for cast iron pipe and special castings, and for manhole frames and covers.

Street Cleaning in New Orleans

Handicapped by great mileage of unpaved streets and unevenness of pavements due to soil shrinkage. Organization, methods, equipment and cost

By C. Schneider*

Street cleaning in New Orleans is conducted by the Division of Public Works of the Department of Public Property. It is confined to the collection and removal of dirt and litter from the paved streets and the flushing of a large number of such streets. There are no macadam streets in New Orleans. Streets that have been surfaced with gravel and shells are graded, but the only cleaning done on them is that of gutters and cutting and removing weeds, which work is not included under the classification of street cleaning. Catch basins are cleaned by the Sewerage and Water Board, an agency of the city government that has charge of all sewer and water systems, but the sediment taken from the catch basins is carted away by the street cleaning forces.

There are approximately 260 miles of paved streets in the city, aggregating in area about 3,200,000 sq. yds. There are a great many types of surface and designs of pavement. Asphalt predominates, but there are considerable areas of brick, granite block and concrete. In the matter of street design, the visitor to New Orleans is at once attracted by the construction of the main thoroughfares, or boulevards. These consist of two separate roadways, usually 24 ft. wide, but in some cases as narrow as 18 ft. and in others as wide as 30 ft., divided by a central unpaved strip, or neutral ground, as it is called locally. The neutral ground carries the street

*Aid to Commissioner of Public Property, New Orleans.

A BOULEVARD OR DOUBLE ROADWAY STREET. ST. CHARLES AVE., NEW ORLEANS

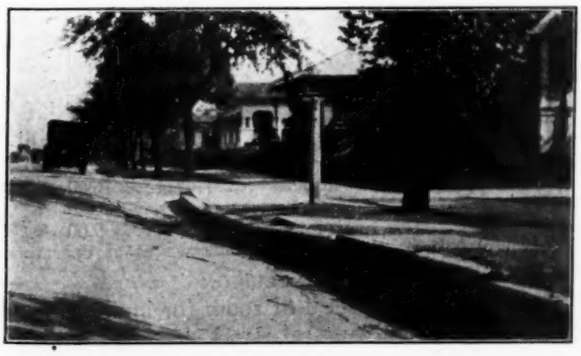
car tracks, where they exist on such streets; in some cases drainage canals occupy a portion of this area. Generally, the neutral grounds are developed with lawns, trees and shrubbery, and occupy no small part in beautifying the city. Such boulevards comprise over 50 miles of paving. Until recently, the standard roadway width of residential streets was 22 ft.; but it has been increased to 26 ft. on recent paving programs. While most paved streets are provided with sub-surface storm sewers, there are a number of paved streets with open gutters, so paved due to the lack of nearby drainage canals at the time of their construction. At present such streets are both dangerous to traffic and difficult to clean.

DRAINAGE CONDITIONS

Before discussing the methods employed in street cleaning, it is thought not inappropriate to mention a few facts pertaining to topography and drainage. These factors indirectly very seriously affect the work of street cleaning. Generally speaking, New Orleans is flat. The land is high nearer the river, and a ridge of high ground extends across the city, about midway between the Mississippi river and Lake Pontchartrain. The term "high," as used here, is purely relative. There is no natural elevation more than 10 ft. above mean gulf level, and the so called ridge is not more than 5 ft. above this level. About 50 per cent of the inhabited portion of the area of the city is at or below gulf level, in some places as much as 3 feet below. The grade on the paved streets does not exceed 8 inches in 300 feet and all streets parallel to the river are practically level. This necessitates the sloping of the storm sewers in order to remove the storm water.

All storm water is removed by canals and pumped into Lake Pontchartrain to the north and Lake Borgne to the east of the city. Natural conditions make it necessary to have separate storm and sanitary sewers. Liberal provision is always made in the sizes of sewer pipes, for heavy rainfalls are very frequent. Catch basins and manholes are so constructed that there is very little or no space for the deposit of sediment. In consequence of flushing by frequent heavy rainfalls, the sewers rarely clog from sediment. The gratings at the inlets of catch basins permit only fine dirt to enter the sewer system.

These points are brought out to show why flushing cannot be more than auxiliary to other methods of cleaning streets in New Orleans. While this method of cleaning is undoubtedly the cleanest and cheapest where it disposes of street dirt and litter, in New Orleans it can only move such dirt to the gutter, where it must be swept, picked up and carted away. However, the merits of keeping the storm sewers clear are indisputable, when the alternative is considered. The flatness of the terrain, the excessive rainfall and the large amount of dirt that is regularly removed from the streets would result in tremendous costs in sewer cleaning and damages, should it be attempted to dispose of street dirt by way of the sewers.



UNEQUAL SETTLEMENT OF CURB AND GUTTER

OPEN GUTTER IN PAVED STREET
Such construction has been discontinued for many years

HANDICAPS TO STREET CLEANING

Two conditions, above all others, handicap the work of street cleaning and greatly affect its cost.

First—The vast amount of unpaved streets is responsible for the fine dirt carried to the paved streets. The unimproved streets in wet weather cause sticky clay to be picked up by every vehicle passing over them, which clay is tracked to the paved streets, where it is spread by other vehicles.

Second—The sub-grade material throughout two-thirds the area of the city is a sharky clay that shrinks as much as 50 per cent upon removal of the moisture content. As this area was once a cypress swamp, numerous stumps underlie the pavement areas. Consequently, upon shrinkage of the subgrade after the storm sewers are laid, the pavement subsides unevenly. Besides resulting in unsatisfactory riding surfaces and expensive repairs, this condition makes street cleaning more expensive and more difficult. Standing water on pavements is as untidy in appearance as dirt or litter.

ORGANIZATION AND METHODS

A superintendent is in general charge of street cleaning. Engaged on the work are about 200 men; 40 bottom-dump, 2 cu. yd. wagons, with double team; 2 motor pick-up sweepers, each followed by a motor truck for removal of the sweepings; and four motor flushers.

Eight crews, comprising 10 to 25 men each, are engaged in day work on sweeping, picking up and carting away the sweepings. One of these crews is assigned to the business section, one to the French Quarter, or Vieux Carre, and the other six cover the remainder of the city. The 10 to 25 men in a crew are not worked closely together, but are scattered as much as supervision will permit. Usually three men will work in conjunction with a wagon that removes the sweepings; in some cases two men can keep a wagon busy, and in others it takes four

men to provide sufficient sweepings. The number of men to a wagon will depend on the quantity of material picked up, the length of haul to dispose of the sweepings and other factors.

In the great majority of cases the cleaning consists of shoveling and sweeping the dirt and litter along the gutter bottom and for a distance of two or three feet out from the curb. Small piles are accumulated every fifty or sixty feet, where they are picked up by the wagon driver and carted away. The tools used are ordinary push brooms, and large, square-pointed, long-handled shovels.

In the commercial section, which contains about 300,000 sq. yds. of paving, the principal cleaning is done at night, all streets in this area being cleaned every night except Sunday. A force of approximately 40 men follows much the same procedure as in the residential section during the day. As the street sweepings consist almost entirely of litter and horse droppings, brooms only are used. In this work, the sweeping is preceded by motor flushing. The routing of the flushers and men sweeping is so arranged as to encounter the least difficulty from parked automobiles. About 50,000 sq. yds. in the more prominent commercial section is flushed with hose every night except Sundays. Motor flushing followed by sweeping has not been able to keep these streets as clean as is done by hose. A day gang patrols a large portion of the business section also.

FLUSHING

The department has four motor flushers, one 1,800 gal., one 1,000 gal., and two 2,000 gal. The 2,000 gal. flushers are of the semi-trailer type. Two machines work at night, and three are engaged on the day routes; hence there is always one machine that can be laid up for repairs. Regular routes are assigned to the flushers. About one-half of the paved streets are flushed once a week; a few of the main thoroughfares, twice a week. Flushers are routed so as to precede hand cleaning, which is followed by pick-up sweepers.

MOTOR SWEEPERS

Two motor pick-up sweepers, one Austin and one Elgin, have been in operation for several months. Their use is confined to main thoroughfares and certain other streets that are in condition satisfactory for their use. Definite routes are assigned to each. Their use has not been unqualifiedly successful, due principally to their inability to function on wet pavements. Loss of time due to weather conditions and other reasons sometimes permits dirt to accumulate on sweeper routes to such an extent that it becomes necessary to clean such streets by hand, particularly during long spells of rainy weather. However, it cannot be denied that, under favorable conditions, street cleaning by motor pick-up sweeper is cheaper and more thorough than by hand. Under the local conditions, hand cleaning is more dependable.

RECORDS AND COSTS

Daily reports are made by foremen and operators of equipment. These reports show the streets cleaned, amount of sweepings removed, labor and equipment charges. Actual yardage is entered at the office from tabulations compiled for the route of each crew. While the areas cleaned are recorded with reference to entire street width, only that area about 3 ft. out from the curb is actually cleaned by hand. Greater widths are cleaned by the pick-up sweepers.

A tabulation of the work done and costs during June, 1927, is given. To these figures should be added an overhead cost of 15 per cent approximately.

Street Cleaning June, 1927

Hand Cleaning

Crew	Sq. Yds. Cleaned	Cu. Yds. Sweeping	Cost Total	Cost Per M. Sq. Yds.	Cost Per Cu. Yd. Sweepings
No. 1	3,255,100	662	$1,518.20	$0.468	$2.30
No. 2	2,504,500	155	857.81	.346	5.59
No. 3	1,965,200	382	1,228.19	.625	3.21
No. 4	992,300	530	1,026.96	1.035	1.94
No. 5	2,465,700	395	1,525.90	.621	3.87
St. Chas. Ave.—					
No. 1	6,427,230	636	2,289.78	.357	3.60
No. 2	3,767,400	654	1,997.34	.532	3.06
Carrollton	1,641,900	603	1,196.70	.728	1.98
Night—Upper	6,650,570	324	1,993.77	.30	6.16
Night—Lower	1,860,000	106	645.35	.356	6.08
Night—Hose	1,332,500	...	450.00	.338	...
Algiers	319,000	146	293.80	.92	2.00
	33,181,400	4,593	$15,023.70		

Flushers

Route	Sq. Yds. Flushed	Total Cost	Cost Per M. Sq. Yds.
No. 1 Day	1,498,600	$421.56	$0.280
No. 2 "	2,640,250	562.08	.213
No. 3 "	2,615,400	562.08	.215
No. 1 Night	2,841,500	538.66	.189
No. 2 "	5,557,500	585.50	.105
	15,153,250	$2,669.88	

Motor Pick Up Sweepers

	Sq. Yds. Cleaned	Cu. Yds. Sweepings Removed	Cost Total	Cost M. Per. Sq. Yds.	Cost Per Cu. Yds of Sweepings
Austin	2,256,400	284	$729.30	$0.323	$2.57
Elgin	2,435,600	278	600.60	.247	2.16
	4,692.000	562	1,329.90		

From this tabulation it will be noted that a wide variation exists in the costs of hand cleaning, the higher costs obtaining where there is a greater amount of material to be removed. This condition is reflected by the lower cost per cu. yd, of sweepings removed by these crews which show high costs for cleaning.

The costs of street cleaning may appear low by comparison with similar figures for other cities. As wages constitute by far the greater part of the expense, the following data are given to permit comparison of figures. All labor is engaged on 8-hour basis:

Rate of pay—Laborers	$2.70	per day
Drivers	3.00	" "
Chauffeurs	3.60	" "
Operators of sweepers and flushers	$110-$120	per mo.
Hosemen	$4.00	" day
Foremen	$100	" mo.
Equipment charges—Wagons	$3.20	" day
Flushers	16.00	" "
Motor sweepers	20.00	" "
Motor trucks	9.00	" "

Equipment charges do not include wages of operators.

CONCLUSION

There is a great deal of room for improvement in our methods and costs of street cleaning. As a material handling proposition, it is expensive, princi-

pally due to the slow loading of wagons by hand from small piles at the curb. The greatest drawback to satisfactory and economical results can be found in inadequate supervision. Some consideration has been given to assigning definite patrol beats to each workman and holding each sweeper accountable for the condition of his beat. Besides the difficulties of properly equalizing the work in this method, there are other disadvantages, and in many respects local conditions would indicate that the scheme is more Utopian than practical. It has also been suggested that the street litter in the commercial section be collected with garbage and rubbish. This scheme has much to recommend it, but is affected adversely by certain other conditions, such as relative times of street sweeping and garbage collection. It is entirely possible that certain organization changes now contemplated may bring about decided improvement in this work. Should such transpire, a later article on this subject may be expected.

Sewer Construction in 1927

Amounts of vitrified, cement, concrete and other kinds of sewers constructed and to be constructed between January 1st and December 31st, 1927, for sanitary, storm and combined sewers in nearly five hundred municipalities. Compiled from information furnished by municipal officials

Municipal officials, most of them city engineers, of nearly five hundred cities have, at our request, filled out questionnaires giving information concerning "sewers laid and to be laid, Jan. 1st to Dec. 31st, 1927—not including house and catch-basin connections." The figures so given have been tabulated in the following tables.

In the questionnaire, cement pipe sewers are defined as those pre-cast, while concrete sewers are those poured in place. These may not be generally acceptable as definitions of these two terms, but the terms are so used here as a convenient method of classifying these two types of construction.

A considerable percentage of the cities reporting are laying no sewers this year. Only 51 percent are laying sanitary sewers and 18 percent combined sewers. Allowing for duplicates, this leaves about 36 percent that are not laying either sanitary or combined sewers. Probably all of these have such sewers in service but the growth of the city does not demand extensions at present.

Replies to questions concerning methods other than sewers for disposing of excreta, and concerning infiltration into sewers, are given elsewhere in this issue.

Vitrified Sanitary Sewers Laid in 1927

Length in feet unless otherwise specified

State and City	Amount
Alabama:	
Anniston	3 mi.
Birmingham	104,716
Dothan	25,000
Huntsville	1,570
Arizona:	
Tucson	925
Arkansas:	
El Dorado	5 mi.
Hot Springs	30,000
Pine Bluff	1.7 mi.
California:	
Alameda	5,000
Berkeley	19,000
Fresno	5,487
Glendale	62 mi.
Hermosa Beach	27 mi. a
Long Beach	41.55 mi.
Manteca	37,430
Modesto	2,600
Ontario	10,000
Orange	660
Oxnard	10,100
Pittsburg	5,000
Red Bluff	2,600
Redwood City	87,000
Richmond	2.3 mi.
San Luis Obispo	3 mi.
San Mateo	22,260
San Rafael	500
Santa Cruz	42,000
Visalia	2,000
Colorado:	
Colorado Springs	13,143
Denver	76,895
La Junta	900
Leadville	12,000
Pueblo	22,400
Sterling	5,880
Connecticut:	
Bridgeport	2 mi.
Bristol	17,800
New Haven	2,000
Stafford Springs	1,029
Wallingford	2,000
Florida:	
St. Augustine	60 mi.
St. Petersburg	110 mi.b
Georgia:	
Brunswick	2,000
Cartersville	1,500
Idaho:	
Pocatello	24 mi.
Illinois:	
Canton	1,500
Carbondale	5,103
Sycamore	600
Wheaton	39,608
Indiana:	
Gary	4 mi.
Huntingdon	1,000
Kokomo	34 mi.
Muncie	1,850
Winchester	5,450
Iowa:	
Charles City	300
Clinton	3,000
Davenport	800
Kansas:	
Dodge City	18 mi.
Herington	3,100
Kansas City	12,300
Newton	30 mi.
Topeka	12 mi.
Wichita	15 mi.
Kentucky:	
Central City	11 mi.
Cynthiana	2,200
Georgetown	6½ mi.
Massachusetts:	
Boston	45,000
Brockton	10,000
Brookline	10,000
Fall River	6,507
Greenfield	1,000
Haverhill	3,000
Lowell	14,784
Lynn	1,818
Orange	3,000
Taunton	2,000
Waltham	7,271
Webster	400
Wellesley	16,000
Michigan:	
Flint	125,000
Hastings	4,800
Kalamazoo	1,478
Royal Oak	27,085
Minnesota:	
Cloquet	1,100
Crosby	668
Fairmont	500
Faribault	3,947
Minneapolis	36,000
Montevideo	5,000
Owatonna	400
Rochester	177,755
Mississippi:	
Corinth	13,100
Missouri:	
Caruthersville	6,000
Columbia	24,554
Excelsior Springs	4.5 mi.
Independence	900
Kansas City	17,000
Kirksville	2,200
Richmond	5 mi.
Sedalia	27,600
Montana:	
Billings	1,220
Havre	1,350
Nebraska:	
Hastings	4,150
Lincoln	13,590
Omaha	7,710
New Hampshire:	
Concord	3,000
New Jersey:	
Belleville	12,000
Freehold	5,000
New Brunswick	6,279
Rutherford	6,500

State and City	Amount
New Jersey (Continued)	
Somerville	600
Trenton	4,500
New York:	
East Aurora	22 mi.
East Syracuse	1,800
Endicott	7,637
Gloversville	2,830
Jamestown	9,600
New York—Brooklyn	1 mi.
New York—Queens	35,884c
New York—Richmond	34,000
Oneida	2,917
Oneonta	2 mi.
Patchogue	3,300
Perry	10 mi.
Rochester	27,900
Rye	8,000
Syracuse	15 mi. b
Watertown	2,100
Yonkers	38,579
North Carolina:	
Durham	70,000
Goldsboro	10,000
High Point	5 mi.
Wilson	23,000
North Dakota:	
Carrington	15,740
Dickinson	11 mi.
Jamestown	2,034
Valley City	780
Ohio:	
Ada	3,000
Akron	10 mi.
Bellefontaine	8,300
Columbus	76,870
Dayton	16,900
East Cleveland	1,185
Elyria	2,500
Lancaster	2,000
Lorain	7,100
Marion	10.75 mi.
Massillon	49,500
Niles	900
Salem	3,500
Shelby	4½ mi.
Warren	6,140
Oklahoma:	
Ardmore	4,200
Muskogee	12,000
Tulsa	90,000
Oregon:	
La Grande	22,340
Portland	$1.000,000c
Pennsylvania:	
Allenton	14.5 mi.
Altoona	2 mi.
Berwick	1,000
Butler	750
Clearfield	900
College Hill	900
Connellsville	3,226
Duquesne	5,522
Ellwood City	3,800
Freeland	6 mi.
Greensburg	8,006
Hazleton	11,530
Lewistown	1,200
Mt. Carmel	1,200
Norristown	2,500
Punxsutawney	2,000
Sayre	1,200
Sharon	12,000
Tyrone	1,100
Uniontown	5,500
Warren	1,325
Washington	3,000
Waynesburg	2,900
Wilkinsburg	1 mi.
Rhode Island:	
Woonsocket	21,300
South Carolina:	
Greenville	5 mi.
Orangeburg	1,200
South Dakota:	
Aberdeen	2,422
Madison	2,000
Mitchell	605
Rapid City	1,500
Tennessee:	
Alcoa	650
Knoxville	12,000
Texas:	
Brownwood	16,500
Childress	25 mi.
Denison	10,000
Jacksonville	20,000
Weatherford	500
Utah:	
Ogden	4,510
Salt Lake City	21,000
Tooele City	7,490
Virginia:	
Danville	17,566
Fredericksburg	800
Roanoke	7,750
Salem	3.03 mi.
Staunton	2 mi.
Suffolk	6,400
Washington:	
Yakima	2,707
West Virginia:	
Clarksburg	10,000
Wisconsin:	
Fort Atkinson	762
Kenosha	32,397
Madison	1 mi.
Rhinelander	3,700
Stevens Point	7,200
Wyoming:	
Cheyenne	24 mi.
Laramie	1,100
Canada:	
Brantford, Ont.	63 mi.
Chatham, Ont.	1,000
Guelph, Ont.	33.5 mi.
Kitchener, Ont.	50 mi.
Orillia, Ont.	1,500
Oshawa, Ont.	1.5 mi.
Port Arthur, Ont.	6,000
Sault Ste Marie, Ont.	3,300
Stratford, Ont.	2,000
Toronto	7,600

a—includes concrete; b—all kinds; c—mileage not known; d—1926 data.

Cement Pipe Sanitary Sewers Laid in 1927

State and City	Reinforced	Not Reinforced
Alabama:		
Birmingham	4,948	....
Arizona:		
Clifton	....	32,000
Tucson	....	30 mi.
California:		
Long Beach	0.89 mi.	....
Newport Beach	....	24 mi.
Santa Cruz	18,235	....
Colorado:		
Leadville	....	4,000
Florida:		
Lakeland	....	60,000
St. Augustine	....	7 mi.
Georgia:		
Savannah	0.5 mi.	16 mi.
Indiana:		
Kokomo	2 mi.	....
Michigan:		
Flint	5,500	....
Missouri:		
Kansas City	15,500	900
Nebraska:		
Omaha	....	1,735
New York:		
Jamestown	2,050	....
New York—Queens	18.8 mi.a	....
New York—Richmond	750	....
Perry	900	....
North Carolina:		
Durham	1,200	....
Thomasville	....	15,000
Pennsylvania:		
Pottsville	875	....
South Carolina:		
Chester	....	10,439
Tennessee:		
Knoxville	....	40,000
Texas:		
Bryan	....	2,000
Corsicana	....	15 mi.
Jacksonville	....	6,000
Wisconsin:		
Beloit	....	3,700
Lake Geneva	....	2,655
Oshkosh	500	....
Canada:		
Brantford, Ont.	1 mi.	....
Guelph, Ont.	1.5 mi.	....
Stratford	2,000	3,000

a—1926 data; 1927 figures not yet available; includes both sanitary and combined.

Concrete Sanitary Sewers Built in 1927

State and City	Reinforced	Not Reinforced
Indiana:		
Kokomo	8 mi.	....
Massachusetts:		
Boston	....	200
Brookline	400	1,600
Minnesota:		
Minneapolis	5,000	....
New York:		
New York—Brooklyn	2 mi.	....
New York—Queens	1 mi. a	....
Ohio:		
Dayton	600	11,000
Pennsylvania:		
Allentown	0.6 mi.	....
Utah:		
Tooele City	....	2,467
Wyoming:		
Cheyenne	8 mi.	....
Canada:		
Guelph, Ont.	....	5 mi.

a—laid in 1926; 1927 figures not available; includes combined sewers.

Other Kinds of Sanitary Sewers Laid in 1927

State and City	Kind	Amount
Florida:		
Lakeland	Cast iron	650
Indiana:		
Kokomo	Brick	4 mi.
Massachusetts:		
Peabody	Brick	0.8 mi.
Michigan:		
Royal Oak	Cast iron	150
Missouri:		
Kansas City	Cast iron	1,200
New Jersey:		
Englewood	Iron	Some
New York:		
Yonkers	Cast iron	1,355
Ohio:		
Akron	Brick	1.1 mi.
Bellefontaine	Cast iron	650
Lakewood	Segment block	5,000
Lorain	Brick	4,600
Pennsylvania:		
Freeland	Cast iron	1,000
Hazleton	Cast iron	900
South Carolina:		
Chester	Cast iron	336

Storm Sewers Constructed in 1927

State and City	Kind	Amount
Alabama:		
Birmingham	Brick	13,464
	Vitrified	27,255
Huntsville	Vitrified	950
Sheffield	Vitrified	1,000
Arizona:		
Tucson	Re. Concrete	1 mi.
Arkansas:		
Pine Bluff	Vitrified	0.7 mi.
California:		
Berkeley	Vitrified	5,000
Fresno	Cement	2,175
San Mateo	Re. Cement	630
	Cement	1,050
Santa Cruz	Re. Cement	31,000
Santa Monica	Brick	15,508
	Concrete	12,015
	Re. Concrete	21,528
	Vitrified	9,768
Vallejo	Vitrified	600
Visalia	Vitrified	300
Colorado:		
Denver	Brick	2,606
	Vitrified	10,611
	Re. Cement	1,990
Monte Vista	Vitrified	3,300
Connecticut:		
Bristol	Vitrified	1,000
New Haven	Vitrified	500
Stafford Springs	Vitrified	602
Wallington	Vitrified	900
Florida:		
Lakeland	Re. Concrete	14,400
	Cement	5,000
Ocala	Re. Cement	255
Georgia:		
Brunswick	Vitrified	800
Savannah	Re. Cement	6.5 mi.
	Cement	3.3 mi.
Illinois:		
De Kalb	Vitrified	900
Kewanee	Vitrified	8,000
Lake Forest	Vitrified	17,380
Wheaton	Vitrified	53,884
Indiana:		
Franklin	Vitrified	3,000
Rushville	Re. Cement	4,300
Winchester	Vitrified	300
Iowa:		
Ames	Vitrified	3,000
Centerville	Brick	275
Clinton	Re. Concrete	500
Waverly	Vitrified	1,300
Kansas:		
Topeka	Seg. block	1,000
	Vitrified	2.5 mi.
Kentucky:		
Corbin	Re. Cement	800
	Cement	2,500
Owensboro	Vitrified	1,200
Massachusetts:		
Adams	Re. Cement	2,600
Boston	Re. Concrete	4,500
	Vitrified	33,000
Brockton	Vitrified	5,000
Brookline	Re. Concrete	500
	Concrete	600
	Vitrified	10,000
Fall River	Vitrified	2,791
	Re. Cement	150
Greenfield	Vitrified	4,000
Haverhill	Vitrified	2,000
	Cement	600
Taunton	Vitrified	1,500
Waltham	Corrugated	304
	Vitrified	2,866
Webster	Vitrified	265
Wellesley	Vitrified	10,000
Michigan:		
Flint	Brick	1,000
	Re. Cement	4,500
	Cement	7,500
Hastings	Vitrified	1,400
Iron River	Vitrified	7,500
Kalamazoo	Seg. block	1,945
	Vitrified	6,303
Mt. Pleasant	Vitrified	2,700
Royal Oak	Vitrified	38,285
	Re. Cement	15,163
	Cement	29,270
	Cast iron	84
Minnesota:		
Brainerd	Vitrified	10,000
Cloquet	Vitrified	250
Crosby	Vitrified	142
Faribault	Vitrified	1,713
Minneapolis	Re. Concrete	2,000
	Vitrified	5,500
	Re. Cement	2,000
New Ulm	Vitrified	3,680
Owatonna	Cement	600
St. Paul	Vitrified	0.51 mi.
	Re. Cement	5.4 mi.
Missouri:		
Columbia	Vitrified	700
Fulton	Vitrified	500
Kansas City	Re. Concrete	500
	Concrete	1,200
	Vitrified	19,650
	Re. Cement	5,000
Kirksville	Vitrified	350
Poplar Bluff	Re. Concrete	2,000
St. Louis	Concrete open channel	7,500
Montana:		
Billings	Vitrified	512
Nebraska:		
Hastings	Seg. block	300
New Jersey:		
Belleville	Re. Cement	3,000
Millville	Cement	700
New Brunswick	Re. Cement	1,463
Prospect Park	Re. Cement	900
Rutherford	Concrete	8,200
	Cement	8,200
Somerville	Re. Cement	800
Trenton	Pre-cast slab	2,900
	Vitrified	1,000
New York:		
Auburn	Vitrified	3,500
Buffalo	Re. Concrete	1,500
East Syracuse	Vitrified	400
Geneva	Vitrified	5,000
Gloversville	Cement	3,370
Herkimer	Vitrified	1,000
Jamestown	Vitrified	2,000
Little Falls	Vitrified	840
New York—Brooklyn	Re Concrete	1 mi.
New York—Richmond	Re. Concrete	930
	Re. Cement	380
Oneida	Vitrified	2,700
Patchogue	Vitrified	1.5 mi.
Rochester	Seg. block	2,700
	Vitrified	12,835
	Re. Cement	2,070
Watertown	Vitrified	1,000
Yonkers	Vitrified	9,378
North Carolina:		
Asheville	Re. Cement	7,022
Durham	Re. Concrete	500
	Concrete	500
	Vitrified	2,500
	Re. Cement	2,000
	Cement	500
Wilmington	Re. Cement	2,000
North Dakota:		
Grand Forks	Vitrified	2,220
Williston	Concrete	2,300
	Vitrified	5,700
Ohio:		
Ada	Vitrified	3,500
Akron	Brick	60
	Re. Concrete	280
	Vitrified	1.2 mi.
Circleville	Vitrified	4,500
Columbus	Concrete	1,700
	Seg. block	5,400
	Vitrified	4,500
	Re. Cement	3,200
Dayton	Re. Concrete	800
	Concrete	5,000
	Vitrified	13,922
East Cleveland	Re. Concrete	4,580
Elyria	Vitrified	1,800
Lorain	Brick	950
	Seg. block	2,400
	Vitrified	6,300
Marion	Vitrified	0.75 mi.
Massillon	Seg. block	2,000
	Vitrified	1,000
Shelby	Vitrified	2 mi.
Toronto	Seg. block	800
	Vitrified	1,000
Oklahoma:		
Muskogee	Seg. block	1,200
	Vitrified	600
	Re. Cement	800
Tulsa	Re. Concrete	9,000
	Concrete	57,500
	Vitrified	25,000
	Cement	20,000
Oregon:		
Corvallis	Cement	2,000
La Grande	Cement	6,000
Pennsylvania:		
Altoona	Vitrified	0.2 mi.
Butler	Re. Cement	2,400
Clearfield	Vitrified	300
College Hill	Vitrified	500
Connellsville	Vitrified	1,941
Duquesne	Vitrified	762
Ellwood City	Vitrified	1,000
Frackville	Cement	700
Greensburg	Vitrified	1,244
Hazleton	Vitrified	3,600
	Re. Cement	4,400
	Re. Concrete	900
Lewistown	Vitrified	600
Norristown	Cement	600
Munhall	Vitrified	2,100
	Re. Cement	100
Sharon	Vitrified	2,000
Tyrone	Vitrified	3,000
Warren	Vitrified	3,700
Washington	Re. Cement	400
West Hazelton	Seg. Block	220
Wilkinsburg	Re. Concrete	800

State and City	Kind	Amount
South Carolina:		
Greenville	Vitrified	3,000
Orangeburg	Re. Cement	1,034
South Dakota:		
Aberdeen	Vitrified	4,822
Madison	Vitrified	800
Mitchell	Vitrified	250
Rapid City	Re. Cement	2,000
Tennessee:		
Clarksville	Vitrified	350
Knoxville	Re. Concrete	500
	Vitrified	5,000
	Cement	11,000
Texas:		
Bryan	Cement	1,000
Virginia:		
Fredericksburg	Vitrified	700
Roanoke	Vitrified	200
	Re. Cement	2,500
Salem	Vitrified	0.6 mi
Staunton	Vitrified	200
Suffolk	Vitrified	500
West Virginia:		
Grafton	Vitrified	1,800
Wisconsin:		
Beloit	Cement	800
Fort Atkinson	Vitrified	1,125
Kaukauna	Cement	1,900
	Vitrified	900
Kenosha	Vitrified	388
	Re. Cement	6,613
	Cement	1,672
Lake Geneva	Re. Cement	1,800
Madison	Vitrified	2 mi.
Oshkosh	Re. Concrete	300
Stevens Point	Re. Cement	5,000
Wyoming:		
Laramie	Re. Cement	5,170
Canada:		
Fredericton, N. B.	Vitrified	7,000
Oshawa, Ont.	Re. Cement	0.5 mi.
	Cement	2 mi.
Port Arthur, Ont.	Vitrified	1,500
Stratford, Ont.	Vitrified	2,000
	Cement	4,000
Toronto, Ont.	Re. Concrete	300
	Vitrified	4,300
	Re. Cement	6,300

Combined Sewers Built in 1927

State and City	Kind	Amount
California:		
Alameda	Vitrified	2,400
El Segundo	Vitrified	69,600
Pittsburg	Vitrified	5,000
Sacramento	Vitrified	100,000
	Re-cement	190,000
Vallejo	Vitrified	3,000
Colorado:		
Pueblo	Brick	1,910
	Vitrified	22,400
	Cement, rein.	14,300
Connecticut:		
New Haven	Vitrified	1,400
Stafford Spgs.	Vitrified	2,000
Georgia:		
Savannah	Re. Conc.	3 mi.
Illinois:		
Joliet	Re. Cement	100
	Vitrified	3,930
Madison	Vitrified	7,500
Indiana:		
Bicknell	Vitrified	6,766
Elwood	Vitrified	1.25 mi.
Gary	Re. Cement	1 mi.
Hartford City	Vitrified	2,668
Huntingdon	Vitrified	3,900
Lafayette	Vitrified	2,176
La Porte	Vitrified	2,800
Michigan City	Vitrified	25,061
Muncie	Vitrified	3,550
Peru	Vitrified	1,877
Terre Haute	Vitrified	600
Iowa:		
Grinnell	Vitrified	200
Keokuk	Vitirfied	600
Kentucky:		
Central City	Re. Cement	1,800
	Seg. blk	1,200
	Vitrified	2 mi.
	Cast iron	100
Dayton	Vitrified	2,820
Ludlow	Vitrified	2,400
Owensboro	Vitrified	2,600
Maine:		
Bangor	Re. Cement	500
	Vitrified	4,700
Eastport	Vitrified	250
Portland	Vitrified	9,225
Massachusetts:		
Fall River	Vitrified	9,238
Haverhill	Vitrified	2,000
Holyoke	Vitrified	3,000
Lynn	Cast iron	20,000
	Vitrified	1,490
Michigan:		
Bay City	Re. Cement	1,200
	Vitrified	1,600
	Brick	77,700
Detroit	Re. Concrete	1,000
	Concrete	125,000
	Vitrified	135 mi.
Halfway	Brick	2,800
	Vitrified	70,000
	Re. Cement	30,000
Highland Park	Brick	1,300
Royal Oak	Brick	190
	Vitrified	107,871
	Re. Cement	13,897
	Cement	6,614
Minnesota:		
Brainerd	Re. Concrete	6,000
	Vitrified	99,200
Minneapolis	Re. Concrete	11,700
	Vitrified	88,000
Moorhead	Vitrified	1,700
New Ulm	Brick	2,150
	Re. Concrete	2,200
	Concrete	1,720
	Seg. Blk.	1,730
	Vitrified	42,240
St. Paul	Re. Concrete	0.6 mi.
	Vitrified	6.2 mi.
	Re. Cement	5.4 mi.
St. Peter	Vitrified	1,940
Missouri:		
Kansas City	Re.Concrete	250
	Concrete	800
	Vitrified	63,000
	Re. Cement	13,500
	Cement	2,000
Moberly	Vitrified	2,000
St. Joseph	Re. Cement	2.94 mi.
	Vitrified	3.46 mi.
St. Louis	Brick	961
	Re. Concrete	19,407
	Seg. Blk.	43,679
	Vitrified	95,439
Nebraska:		
Omaha	Re. Concrete	11,060
	Vitrified	21,036
	Re. Cement	9,124
	Cement	6,133
New Jersey:		
Bayonne	Cast iron	1,200
New York:		
Auburn	Vitrified	1,550
Buffalo	Re. Concrete	3,000
	Seg. Block	2,000
	Vitrified	50,000
New York—Brooklyn	Brick	1 mi.
	Re. Concrete	5 mi.
	Seg. Block	1.5 mi.
	Vitrified	12 mi.
Rochester	Vitrified	12,180
Yonkers	Re. Concrete	794
	Vitrified	12,523
	Cast Iron	226
North Dakota:		
Carrington	Vitrified	15,606
Grand Forks	Vitrified	3,480
Ohio:		
Akron	Brick	1.7 mi.
	Seg. Blk.	3.5 min
	Vitrified	14.0 mi.
Bucyrus	Vitrified	750
East Cleveland	Vitrified	570
Zanesville	Vitrified	1,540
Pennsylvania:		
Altoona	Vitrified	0.1 mi.
Berwick	Vitrified	3,000
Franklin	Vitrified	420
Hazleton	Vitrified	200
Oil City	Vitrified	258
Scranton	Vitrified	14,804
West Hazelton	Vitrified	1,175
Tennessee:		
Knoxville	Re. Concrete	2,873
	Vitrified	2,000
	Cement	16,000
Vermont:		
Montpelier	Vitrified	1,400
Newport	Vitrified	1,000
Washington:		
Wenatchee	Vitrified	2,630
Yakima	Cresoted wood	425
West Virginia:		
Grafton	Vitrified	220
Williamson	Vitrified	0.5 mi.
Wisconsin:		
Kaukauna	Vitrified	52,100
Kenosha	Vitrified	5,541
	Re. Cement	2,948
La Crosse	Vitrified	5,007
Oshkosh	Re. Cement	2,985
Racine	Re. Concrete	3,040
	Re. Cement	8,200
Canada:		
Chatham, Ont.	Vitrified	5,000
Sarnia, Ont.	Vitrified	1,200
Toronto, Ont.	Brick	31,725
	Re. Concrete	4,000
	Concrete	5,365
	Vitrified	54,500
	Re. Cement	336
Valleyfield, Quebec	Re. Cement	2,500

PUBLIC WORKS

Published Monthly
at 243 W. 39th St., New York, N. Y.

S. W. HUME, President J. T. MORRIS, Treasurer

Subscription Rates
United States and Possessions, Mexico and Cuba $3.00 year
All other countries..... $4.00 year
Single copies, 35 cents each

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Telephone (New York): Longacre 8176
Western Office: Michigan-Ohio Building, Chicago
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CONTENTS

Sewerage Information in This Issue

In this issue, in addition to tabulated statistics concerning sewer construction, will be found ten articles dealing with sewerage and sewage treatment. One of these gives information concerning entrance of ground water into sewers in several hundred cities, while two others describe how tight joints were secured under difficult conditions. Our investigation shows that this is a question of great concern to the majority of cities, its importance increasing as sewage treatment becomes more general.

The other articles discuss recent ideas and methods in sewage treatment which will undoubtedly interest operators and designers of plants. One describes the burning on sludge beds of air-dried sludge containing 50 per cent moisture or more. (More detailed information concerning this will be given next month.) Another tells of running wet sludge onto farm land and its higher fertilizing qualities as compared to dried sludge. Sludge disposal has always been and still remains the most serious problem in sewage treatment, and any suggestions towards solving it are welcome, even though applicable under certain conditions only or merely indicating a possibility rather than describing a fully worked-out procedure.

Discussions concerning the activated sludge method, comparing two ideas as to one of the principles involved in its functioning, have a direct bearing upon the question of whether future development shall be along the line of forced aeration, or surface aeration with mechanical agitation. The former was employed in the earliest plants, and remains the common if not the standard method in the United States, although a very few plants here have recently tried mechanical agitation. In England, however, at least two different types of plants using surface aeration with mechanical agitation have been developed and put into service in several cities. These are compared in three articles, as to the natural phenomena involved, the effectiveness and the economy.

Another article describes how a disposal plant was installed temporarily in a building designed ultimately to house a sewage pumping plant; and still another tells of economy in sewer construction and maintenance secured by the use of up-to-date mechanical appliances.

Sewage Disposal in Unsewered Areas

Of the more than 400 cities reporting sewerage data, only 20 were completely sewered, the unsewered areas of the others being served by various substitutes. Small septic tanks lead these, being reported as used by 112 cities for serving homes beyond the sewer lines; 124 cities reported the use of cesspools, and 80 cities still use the outdoor toilet where sewers are not available.

During the past few years, small septic tanks have come very rapidly into use; they are now displacing cesspools in many places. Properly installed they give service over a period of many years; and as the information regarding the proper methods of installing them becomes more general, their use and value will increase, and they may replace entirely the cesspool, which operates satisfactorily only under very favorable conditions of soil, and the outdoor toilet, which appears to be, for some sections, still a necessary evil.

No city can hope to have a low death rate from typhoid, colitis, and the other filth-borne diseases, unless its unsewered areas are properly cared for. Until this is done, the other and very important refinements of health work—milk control, hospitilization, and general health work—are very largely without result.

Flood Discussion by Engineers

Editors of daily papers and non-technical writers of letters to the same have presented to the public their ideas on what should be done about the Mississippi river, the total probably reaching miles of newspaper columns. The public, however, seem to realize that the problem can be solved only by those professionally qualified to judge—civil engineers. More complete and intimate information concerning and experience with the Mississippi and its vagaries has been accumulated by the U. S. Army engineers than by all others combined; but there is a popular feeling that the Army is committed to a scheme which has been demonstrated to be inadequate, and that other engineers with experience along this line should be consulted.

At the convention of the American Society of Civil Engineers in Columbus, Ohio, October 12th to 14th, two-thirds of the entire two days will be devoted to a discussion of this subject. In view of the feeling concerning the Army engineers just referred to, which is shared by some civil engineers, it is perhaps unfortunate that eight of the papers are to be contributed by Army engineers and four by engineers in other Federal departments; but seven others will be presented by civil engineers and four civil engineers are scheduled for a discussion of the subject, so that there is almost a fifty-fifty balance between the two.

The papers, judging from the titles, will give a summary of the information on the subject acquired by the Army engineers, and will discuss forest cover, reclamation, reservoirs, levees, spillways, auxiliary channels, relief outlets and by-passes, and their possibilities as mediums for preventing a recurrence of floods like this year's or the disastrous results thereof. They will be read and discussed by Army engineers and leading hydraulic engineers and any who are interested in the subject will undoubtedly by well repaid by attending this meeting. It is to be hoped that a summary of the high points and the general tenor of the discussion will be prepared by some one competent to do so and, stated in language easily comprehensible by "the man in the street," will be given wide and general publicity; if for no other reason, to offset the garbled and probably in many cases incorrect versions which will probably be prepared by reporters for the papers.

Airports Increasing

There are 864 airports and intermediate landing fields already established in the United States, according to a report prepared by Wm. P. McCracken, Jr, Assistant Secretary of Commerce for Aeronautics. Of the 864 fields, 207 are municipally owned. In addition, 93 municipal fields are proposed.

In his report, Secretary McCracken states:

"During the past year, more than 50 new airports have been established and twice that number of cities have set aside funds or have begun plans for modern airports. Chambers of Commerce, business clubs and other civic organizations are cooperating in the effort to build up a complete airway and airport system. By the end of 1927, about 1,000 airports and intermediate fields will dot the United States from coast to coast and from the Canadian border to the Gulf of Mexico."

Calcium Chloride in Gravel Roads

As stated in the May issue of Public Works, the Michigan State Highway Department has developed a method of using calcium chloride in the construction and top finishing of its gravel roads, and has used it very extensively this year. The method consists of combining with finely screened gravel from 6 to 12 per cent. of finely ground clay, the amount depending upon the texture of the subsoil, and about 6 tons of calcium chloride per road mile. These are well mixed, spread and rolled. The calcium chloride absorbs moisture from the air and keeps the clay moist and retaining its binding qualities. In preparing the road surface, all oversize pieces of gravel are removed; which large, rounded stones formerly tended to roll under the wheels of traffic.

Municipal Work by Day Labor and by Contract

Municipal engineer handicapped by lack of freedom to hire men and fire them instantly, to favor good workers by extra pay, and otherwise. Why some contractors can bid low

Writing on this subject in "The Surveyor" (London), an English engineer submits some ideas that are not often referred to in discussions arguing for or against day labor work. He says that a contractor can generally do public work cheaper than can an engineer by day labor, not entirely because of the greater experience and efficiency of the contractor and his staff but because the engineer is under a handicap, due to the prevailing system of government and abundance of red tape, rules and regulations which hamper him on every side. For instance, men can not be fired so easily. "A contractor's foreman informs a slacker, in the appropriate drawing-room style of language, to get his 'cards' from the office. The man can be paid off at an hour's notice, and he knows it, and so do the whole gang; consequently the good men work better. Fear of the 'sack' may be a cruel and unmoral weapon, but it is wonderfully efficient.

"Not so on a council job. The time sheet has to be made up to the end of the week, and a whole lot of rigmarole gone through before a man can be 'stood off.' Owing to financial regulations, which leave officials unprovided with petty cash, there is no fund out of which a man can be paid off on the spot. This is a great handicap. Furthermore, a contractor can distribute 'palm oil' to small sub-contractors, carters, etc., and thereby gain these men's cooperation. For instance, one hires a horse, cart and

man per day. The carter is supposed to help load. Does he? Not very often. Yet a couple of 'bob' on Saturday slipped into his hand would be almost as good as engaging another navvy for the week. No engineer can charge up such an item, nor would the auditor pass it for payment.

"Again, a contractor has a free hand with his labor and can pick whom he will and import labor if he chooses. The engineer has to try and find a job for all the unemployed and work-shys Councillor Blank and Alderman Dash send along. To say the least, it would be very impolitic not to give them a start; although they look as if work and themselves had quarrelled years ago and never made it up." (Apparently human nature is even more human in England than in America).

"If a contract is let, many additions have to be paid for as extras; whereas, in a direct labor job, there is the risk of councillors making suggestions amounting to orders for variations to be made for which no money is provided in the estimate, and yet they have to be squeezed in somewhere in order to keep the peace. Rates of pay and the methods of payment all hamper the engineer. Every one knows that it pays to give the good man a bit extra. A contractor can do this by paying each man in a separate docket, and either increasing the rate per hour or giving the good man a few hours per week; but on a council job, where every man signs the wages sheet and sees what the other fellow gets, the system would be productive of dissatisfaction."

The same anonymous author also has some ideas on bidding. He believes that some contractors can bid lower than others because they secure more complete and intimate information about the work from the engineer in charge of the letting. "Generally speaking, when inspecting drawings and obtaining bills of quantities, etc., a contractor's representative is turned over to one of the assistant engineers. Some gentlemen make the fatal mistake of assuming that because he is not the chief official, the assistant must be a bit of a fool. Of course he may be, but there is no need to rub it in; that is not the way to get information." (Apparently the author, who signs himself "Engineering Assistant," is human, too.) "In my opinion a man of charming personality, essentially tactful, will go back with his notebook full of most useful local knowledge," such as names of truck owners, local labor rates, where materials can be got and approximate costs; with all of which the assistant engineer is probably more familiar than his chief. The author did not think that low bidders on a job are going to underpay their labor and purchase third-rate materials, or get extra discounts on purchases, but he attributes their close bidding to superior business ability in acquiring information as to costs.

Having got the job, he believes that some contractors lose out on it because they rub the engineer the wrong way, or because they spend too much time in the office trying to figure out how they can put in a claim for extras when their presence on the work would enable them to save more by efficient operation than the extras would amount to—if they got them.

All of which is confessedly the view of one angle of the subject from an engineer's point of view.

Sanitating a Small City

Under this heading there was described in the September, 1922, issue of PUBLIC WORKS the steps employed to reduce typhoid fever prevalence in Leeds, Ala. The results of this work, completed five years ago, are now apparent.

Since 1922 Leeds has grown very rapidly in population. The 1920 census gave Leeds a population of 1,600; 399 toilets were installed in 1922, indicating a population of about 2,000; in 1926 there were over 800 homes and the population was estimated as being in excess of 4,000. During 1924 and 1925, coincident with the establishment of a new industry, the influx of population was very rapid, and installation of sanitary measures lagged behind. Many people were living in tents and drinking creek water, or water from shallow and dangerous wells.

A water supply system was constructed in 1924 and 1925, but full service to the majority of the homes was not estabished until late in 1925.

Fig. 1 shows the number of typhoid cases reported during the period 1921-1926. The effect of the sanitary work done in 1922 is very apparent, as is the typhoid increase in 1925 due to crowding and lack of toilets, and of an adequate water supply. The happy ending in 1926 illustrates what almost invariably happens when there is a fair degree of sanitation and a supply of good drinking water is available. From 58 cases in two years among a population of about 2,000, typhoid has been reduced to an average of 5 cases a year in a population of about 4,000. The results so far in 1927 are satisfactory, and should lower the average still more.

The toilets installed in 1922 (septic toilets) are not considered as being among the best and most practical toilets, due to the high degree of care necessary in their operation, and to other factors, but the use of this type was dictated by the unusual situation at Leeds as described in the previous article.

Along with the reduction in typhoid there was a very considerable reduction in deaths from all causes, and a most remarkable decrease in infant mortality. These phenomena almost always accompany a sanitary campaign, though not always to a similar degree. A large part of the decrease in infant mortality was, without doubt, due to the excellent nursing work carried on by the divisional nursing staff of the county health department, which work was established coincident with the completion of the toilet construction program.

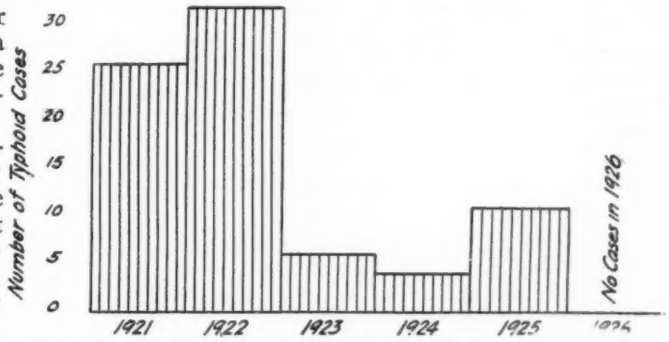


FIG. 1—DECREASE IN TYPHOID FEVER CASES IN LEEDS, ALA., FOLLOWING CONSTRUCTION OF SANITARY TOILETS

New Orleans' New Filter Plant

Seventeen-year-old plant, now outgrown, being more than doubled in capacity by extensions involving new features

The city of New Orleans has for about seventeen years been operating a water purification plant with an original capacity of 40,000,000 gallons daily which partially softens, coagulates and filters the water and furnishes a clear, palatable, and relatively soft water of a high degree of bacterial purity. This plant reached its economical and effective capacity some time ago, and by 1924 the average daily consumption was about 45,000,000 gallons and the daily peak 60,000,000. But it was not until February, 1924, that funds were available for starting construction on extensions and work was actually started early in March, 1924. The new plant is still under construction, one of the filter units having gone into operation about the first of this year. A brief general description of the new plant was given by John L. Porter, purification director of the New Orleans Water Board, before the annual convention of the Southwest Water Works Association. The more interesting points of his description are given below:

The new installation is to consist of eighteen 4,000,000 gallon filter units, together with an equalization reservoir underneath these filters, two grit reservoirs, two lime mixing reservoirs and four coagulating reservoirs; together with pumps and other necessary equipment.

The soil in and around New Orleans is unstable and settles from 6 inches to 2 or 3 feet when it is drained out, and consequently all structures must rest on pile foundations driven through sand strata 40 feet or more below the general surface. The original equalization reservoir, which also was below the old filters, had a floor of the inverted groined arch type of construction, partially reinforced, and the roof, which supported the filters, was also of the groined arch type. The new equalization reservoir was built with both floor and roof of the flat slab type of construction fully reinforced and resting on approximately three thousand piles.

The greatest need was for new filters and the construction of these was begun first. Early this year work was begun on constructing the new grit reservoirs, lime mixing reservoirs and coagulating reservoirs. Each of the two grit reservoirs will be of approximately the same width as the original grit reservoir but nearly twice as long. These will have a baffle located centrally in the reservoirs, as in the original construction; but in the new coagulating reservoirs the baffles will be located so as to provide about twice the area in the incoming side of the reservoir as in the outgoing side; this to provide more economical operating conditions, since past experience has shown that fully 90 per cent. of the suspended matter precipitates in the first part of the incoming side of the reservoir, but due to its fluidity distributes itself quite uniformly over the entire half of the reservoir.

Bucket elevators and screw conveyors will carry the lime and iron, used in treating the water, from the cars to the bins or to the daily feed hoppers located above the chemical solution tank, or from the storage bins to the daily feed hoppers. From the feed hoppers the chemicals will be fed through weighing machines to the slaking tanks in the case of lime and to the solution tanks in the case of the iron sulphate. From the solution tanks the chemical solutions will flow through chemical controllers controlled by a proportional flow regulated by the venturi meter on the incoming water.

In the new reservoir system, all baffles and skimmer walls which rest on the floors of the reservoirs, which are not supported by piles, are to be constructed of wood, as the settlement of reservoir floors has been considerable and not uniform, which makes it very difficult to maintain concrete baffles in good alignment.

For removing sediment from the reservoirs a pump is provided with a capacity of approximately 8,000,000 gallons in 24 hours, which will pump the mud through a 20-inch discharge line to the river.

In the original filter installation, the filters were washed by water stored in wash water tanks supported on the roof trusses of the filter gallery, which tanks were filled from the high pressure distribution system. In the new installation, duplication of wash water facilities is being provided by the installation of a wash water pump located in the new 8-filter pipe gallery and connected with the wash water piping system of the new filters, which in turn is looped around and connected to both ends of the main wash water line of the old filters. This pump has its suction arranged to take water either from the equalization reservoir or from the clear water reservoir, and its discharge arranged to deliver water into the wash water line or the wash water tank or to deliver water from the equalization reservoir back into the clear water reservoir. This last arrangement provides a duplication of the existing pumping arrangement in the pumping station for filling the clear water reservoir, which is rendered advisable by reason of the use of this group for circulating condensing water to the steam-driven turbines located in the power house.

Probably the most radical change in the filters is the new type of underdrain or strainer system. In water softening plants it is found necessary to change periodically the gravel layers, which become coated with deposits of lime and magnesia. In some types of strainer systems this is a difficult and expensive operation. An effort was made to devise and construct a filter bottom which would be equally efficient in wash water distribution, less difficult to maintain and less expensive to construct. The pipe grid system of underdrains as used in some plants, while having some advantages, did not appear to provide uniform and sufficient distribution of wash water. A type of underdrain was developed by Eugene Delery, assistant engineer on design, which it is felt meets the requirement to a

greater degree than any existing type of strainer system.

This underdrain system consists essentially of a main conduit formed of concrete at the bottom of the central gutter of the double filter units, with curved branches of cast iron which are imbedded in the concrete at the bottom of the passage, the axis of which makes an angle of about 40° with the axis of the conduit and the inlet opening of which conforms to the curvature of the conduit. These bends terminate in bells which are flush with the outer walls of the passage. Into these bells are leaded brass tubes of 4¼ inches outside diameter made of No. 20 gage brass, and closed at the far end. In the bottom of these tubes are perforations made by a special machine which cuts the metal of the tube and it depresses it, forming an indentation which projects into the tube against the flow, producing the effect of a pitot tube introduced into the flow. There are two rows of perforations in each tube spaced three inches apart in each row, giving eight perforations per foot of tube, which are spaced on one-foot centers throughout the end of the filter units. The advantage of this type of underdrain is that it enables the construction to be entirely above the bottom of the filter, takes up a small amount of headroom, gives a uniform distribution of wash water, and costs very considerably less than the original type of underdrain, $1,500 to $2,000 less per 4-million gallon unit.

In an experimental filter of 1,000,000 gallons capacity using 2¼-inch tubes, an efficiency of 99 to 99½ per cent of distribution was obtained with wash water rates of 6 to 8 times normal rates of filtration, and in the first of the new 4-million gallon units, where the perforations were made somewhat larger in order to utilize the relatively low available heads of the existing wash water tanks before the completion of the wash water loop line, an efficiency of 95 per cent. was obtained.

The controllers in the new plant will be of the venturi type controlled by equal pressure diaphragms which have been developed by Mr. Earle. This type of controller not only governs the rate of filtration but also serves to measure the flow of each individual filter as well as the total output of all the filters governed by the master controller.

The sand used in the original plant was a beach sand obtained from Horn Island, an island in the Mississippi sound about 100 miles from New Orleans. This sand has an effective size of .35 mm. and a uniformity coefficient of 1.65. It was relatively expensive and an attempt was made to find a cheaper sand which would be equally satisfactory. A bank sand of approximately the same effective size and uniformity coefficient was obtained and put into two of the filters and conditioned by washing repeatedly and then scraping off the top layer. The result of operation with this new sand indicated that, owing to the present of relatively small amounts of very fine sand which are not completely removed by washing and scraping, much shorter runs between washings were obtained and the greater expense for Horn Island sand is considered justified because it gives more economical operating conditions.

Pollution and Natural Purification of Illinois River

Brief abstract of report by U. S. Public Health Service giving result of investigation. Bacteria content a sensitive index of sanitary condition of water.

In pursuance of its policy in research investigations of stream pollution and natural purification phenomena, the United States Public Health Service, in cooperation with the Sanitary District of Chicago, instituted a study of the Illinois river, the field work of which was carried out during the years 1921-22. Surveys were made to ascertain the sources and amounts of polluting materials discharged into the stream, hydrographic features of the river and its main tributaries were ascertained, and laboratory observations were made over a period of about a year to determine the chemical, bacteriological, and biological condition of the river water throughout the stream length. The report on these features of the study has just been issued as Public Health Bulletin No. 171. (See PUBLIC WORKS for February and April, 1926).

The natural drainage area of the Illinois river, comprising a total of 28,344 square miles, has been increased by the construction of the Chicago drainage canal, through which the combined sewage of Chicago, with dilution water diverted from Lake Michigan, is discharged into the headwaters of the river. Of a total population on the watershed of nearly 3,400,000, over 80 per cent, or approximately 2,800,000, thus contribute sewage through the canal. Industrial waste pollution amounting, in terms of population equivalents, to about 67 per cent of the total of the watershed, originates from the same source. The volume of flow of the Chicago drainage canal, averaging 8,650 second-feet during the period of the field studies, amounted to over 30 per cent of the mean discharge of the river at a point 23 miles above its mouth. The proportionately large and relatively constant volume of water discharged into the headwaters of the river has the effect of stabilizing its velocity of flow to a marked extent.

For observing progressive changes in the chemical and bacterial content of the river water throughout the stream length, sampling stations were located at intervals not exceeding 25 miles apart, samples being collected and examined from each station three or six times each week. The samples were examined at four laboratories located, respectively, at Joliet, Peoria, Beardstown, and Kampsville. The observations, including those of turbidity, alkalinity, dissolved oxygen, oxygen demand, and bacteriological tests (including plate counts at 20° C. and 37° C. and *B. coli* index), were made on all individual samples collected. Sanitary chemical analyses, including oxygen consumed and nitrogen in its various forms, were made of composited samples preserved with sulphuric acid. From se-

lected points, samples of river water and of bottom sediment were collected and examined regularly for plankton content.

From the sanitary chemical analyses it is estimated that 7 to 8 per cent of the water flowing into the Illinois river through the Chicago drainage canal is sewage, 93 to 92 per cent being dilution water. The total nitrogen content of the river water appears to remain fairly constant throughout the year. No nitrates appear to be produced above Peoria, especially in the summer. In general, the progressive changes observed in the nitrogenous constituents of the water were not sufficiently great to be significant. The oxygen relationships, which provide a more sensitive index of conditions related to nuisance causation, will be discussed in a later report.

The numbers of bacteria in Illinois river water and their progressive changes, which provide an extremely sensitive index of the sanitary condition of the water and of its rate of natural purification, were studied in considerable detail, both from the viewpoint stated and from that of comparing the rates of bacterial change observed in this stream with those previously observed in the Ohio river, under various seasonal and other physical conditions.

These observations, continued throughout an entire year, have supplied sufficient information to permit evaluating the excessive bacterial pollution of the river by the wastes of Chicago. The density of bacteria is reduced very rapidly in the upper reaches of the river and, progressing downstream, at slower rates until at Peoria the average numbers growing on agar seldom exceed 4,000 per c. c. in summer and 2,000 per c. c. in winter. Pollution contributed by the Peoria district again imposes a considerable bacterial load on the stream, likewise tending to diminish at subsequent downstream points, until, at the mouth, the bacterial content of the Illinois compares quite favorably with that of the Mississippi river at the junction.

The rates at which the bacteria decrease are dependent on seasonal temperatures, being much more rapid in summer than in winter. When necessary corrections are made for pollution added by tributaries and intermediate cities, these rates are quite well defined by the observational data and may be represented, in general, by smooth curves fitted to the observations and plotted with respect to the time of flow elapsing between successive sampling points. Such curves, though having the same general characteristics as those found to fit similar observations made on the Ohio river, are yet distinctive in that the initial rates of decrease are more precipitous as a rule. However, when the differences in initial bacterial concentrations are taken into consideration and the curves adjusted for this condition, they are more nearly comparable.

Burning Sewage Sludge

Burning air-dryed sewage sludge at the Merchantville-Pennsauken sewage treatment plant was described by Raymond G. Case, manager of that plant, before the New Jersey Sewage Works Association at its annual convention. This plant consists of three clarification tanks, each 60 feet by 12 feet by 12 feet deep, which tanks are provided with Link-Belt conveyors which scrape the sludge into a sump, from which the fresh solids are drawn into a wet well and pumped into a digestion tank from which the digested sludge is drawn onto sludge-drying beds of abundant area.

During the summer of 1925 there was a period when the weather was very dry and the sludge began to crack into blocks about the size of Belgian blocks. Mr. Case started a fire of dry grass on top of the sludge to see whether it would burn and found that it did so without difficulty, leaving about 10% residue. The ash looked like red road gravel after it had cooled, and while it was burning gave off an intense heat which at times became white heat on the inside of the heap. There was however, no objectionable odor. This ash could be removed from the bed in about one-fifth the time it would take to clean the bed had it not been burned. An analysis of the sludge burned showed that that on one bed contained 49.2% moisture at the time of being ignited and another bed 59.7% moisture. The entire dryings of that year were disposed of in this manner. The summer of 1926 was abnormally wet and Mr. Case did not believe it would be possible to burn the sludge; but on a visit to the Northeast plant in Philadelphia, he was informed by M. J. Blew that he had burned sludge successfully with as much as 60% moisture. Following this, Mr. Case found it possible to burn comparatively wet sludge at the Merchantville plant, although it took more fire to start it burning.

English View of Sewage Disposal

Comparison of present status of dilution, irrigation, contact beds, percolating filters and activated sludge. Tank treatment and sludge disposal.

In a paper read recently before the Institution of Municipal and County Engineers, of England, J. D. Watson, late chief engineer to the Birmingham, Tame & Rea District Drainage Board, stated what, in his opinion, is the status in England at this time of the various types of sewage disposal methods and processes.

DILUTION

Speaking concerning dilution he said: "Where the laws of nature are allowed to assert themselves, dilution may be and frequently is a purification process in itself. Organic impurities are rendered innocuous or are dissipated by bacteria and protozoa, which form the plankton of the waters. As with all methods of purification effected by the forces of nature, anyone guilty of overtaxing the purifying power available courts disaster (as instanced in the well-known cases of the Thames, the Clyde, the Chicago Canal and many others); but when the volume of sewage is reasonably apportioned to the volume of diluent, salt or fresh, dilution is an

authenticated method of purification which never fails."

LAND IRRIGATION

Where soil and subsoil are suitable and the volume of sewage to be treated is well within the purifying capacity of the area available, land irrigation is probably the soundest method of purification. Different opinions may be held regarding what are favorable conditions, but it may be assumed that, where there is one acre of suitable land per one hundred persons, an efficiently worked sewage farm, when judged by the standard of effluents produced, is still in the front rank. (In the discussion, E. J. Silcock, of Leeds, expressed the opinion that Mr. Watson was very conservative, since he thought that almost any land should deal with the sewage of more than 100 persons per acre.)

CONTACT BEDS

In the order of sewage purification development, the contact bed comes next to land irrigation; but one cannot say for it what has been said for land irrigation, that it stands where it did. It is not, in the opinion of experts, either a sound or an economical way to oxidize and free sewage from its tendency to putrefy. . . . That the contact bed is capable of oxidizing sewage efficiently there is no doubt, but compared with other biological methods of treatment it is less reliable. The beds readily become clogged with suspended matter; they consequently lose capacity, and the medium has to be taken out, cleaned and replaced too frequently. If much suspended matter is put on fine filters, they are likely to choke unless the time of aeration is increased abnormally. The Royal Commission stated that one cubic yard of medium used in the form of percolating filters is capable of performing the same duty as two cubic yards of medium used in the form of contact beds.

PERCOLATING FILTERS

The percolating filter is popular, and deservedly so. It is comparatively cheap to construct where good medium is obtainable in the locality; the operating cost is low, and the effluent when passed through a well-designed humus tank is clear and non-putrescible. For twenty years or more this form of oxidising filter has been almost without rival.

Compared with an activitated sludge plant it may be called "fool proof," and its bacterial population is wonderfully adaptable to varying conditions, including change of temperature and character of the sewage to be treated. These good attributes often tempt an untrained manager to leave the filter so long without attention that it is made to appear as if it were constitutionally weak, whereas it has been badly damaged by neglect.

In first cost a percolating filter is more expensive than an activated sludge plant, but it is cheaper from the ratepayers' point of view, because the assessment required to meet principal, interest and maintenance is less, and this, after all, is the real test. The process in view of its reliability to produce good effluents at a low maintenance cost is not behind in the race for economy. It is not, however, free from potential nuisance.

In spite of this there is no gainsaying the fact that the percolating filter is popular with the engineer, the local authority, the manager of the works, and last but not least, the rivers authority. This very popularity may be unduly stressed, and sometimes it may lead to neglect of the bed and to its being deprived at the right moment of that skilled attention so necessary to avert falling away from normal high-class work.

ACTIVATED SLUDGE

The activated sludge or bio-aeration process is not so popular as it was a few years ago—not that it has gone back in the estimation of the experts, but it has failed to maintain its popularity in the estimation of local authorities. It is probably suffering from the untoward zeal of some of its advocates and their belated consciousness of its limitations.

Nothing has happened in the past few years to shake one's faith in the value of this process *per se*. Its suitability for certain kinds of work is unchallenged. It has proved itself to be scientifically sound. It concentrates the purification process by confining the whole operation to one or more tanks, but it is not suitable for the treatment of all kinds of sewage, nor is it economically adaptable to all situations. It is sensitive to quick change in the character of the incoming sewage. The maintenance of a fixed volume of given trade waste to a given volume of domestic sewage is of greater consequence than it would be in a less sensitive plant, and its success as a reliable method of purification requires more knowledge and skilful management on the part of the local authority than the older and better understood methods of treatment.

The names activated sludge and bio-aeration have been directly associated with the Manchester and Sheffield plants, but other mechanical contrivances working at Bury and Birmingham include what have been called the Simplex surface aeration and the Spiro-Flow processes.

It is all to the good that there are different ways of applying the principles involved in this process of sewage purification. They are all trying to reach the same goal by different, but more or less direct, routes.

By the first and best-known method air is forced through porous tiles placed in the bottom of great channels or elongated tanks, through which sewage is made to flow, and is kept in constant contact with dissolved oxygen and minute particles of sludge, each paritcle acting as a *nidus* for innumerable particles or aerobic bacteria.

Mechanical agitation has proved itself to be sound in its conception, and may in some instances be cheaper in its operation. It may be quite as reliable in the production of a good effluent; it may be a simpler mechanical plant unencumbered by patent rights to control the process, and yet it cannot be said that the Sheffield method has taken a greater hold of the consulting engineer than the Manchester method.

It should not for a moment be assumed that an ideal method of utilising the principles of the process has yet been discovered. The plant inaugurated at Essen-Recklinghausen, which com-

bines both air-blowing and mechanical agitation, may yet be a keen competitor, if it proves to be as economical as it is reputed to be efficient. It will provide a stimulus to our mechanical engineers to emulate and excel what has been done in Germany.

The principal object to be gained by adopting activated sludge or bio-aeration should be clearly kept in mind. The public have been led to believe that this new discovery will result in the supersession of land irrigation and bacterial beds. This is not the case. The discovery has added another excellent method of purifying sewage to those already available, but it is not necessarily the best method. It is not suitable for the treatment of every sewage, nor is it, generally speaking, so reliable under all circumstances as the older and better-tried methods. Indeed, the very fact that it required so much more skilled attention than either land irrigation or bacteria beds, renders it unsuitable where the works are isolated and small. It has, however, opened up paths by which existing biological plants like contact beds and percolation filters may be rejuvenated and made more capable of treating the volume of sewage for which they were originally designed, by relieving them of work for which they are not suited.

All who have had experience of the management of bacteria beds are conscious of the handicap created by spraying tank effluent of a highly colloidal character over the surface of a bacteria bed. Given sufficient time, aerobic bacteria and higher organisms, like *Achorutes,* will free a bacteria bed from viscous matter which sometimes spreads itself over the surface like a sheet of soft India rubber; but if the activated sludge process is adopted as an auxiliary to bacteria beds the sewage liquor, after it has been subjected to air blowing or surface agitation for even one hour, is free from colloids and other viscous matter in a marvellous way. As a result a bacteria bed will be able to oxidise at least double the quantity of liquor which it could oxidise if that liquor still held colloidal matter.

At Birmingham, as the result of experiments extending over some years, the author recommended the joint drainage board in the spring of 1922 to put down an auxiliary plant of this kind, and the grounds emphasised in making the recommendations were as follows:

(1) That the Birmingham sewage is amenable to treatment on this principle—bio-aeration.

(2) That a tank liquor forms a better subject for purification than crude sewage.

(3) That agitation of tank liquor for one hour removes 60 per cent of its impurity.

(4) That agitation of tank liquor for one hour removes all objectionable smell.

(5) That agitation of tank liquor for one hour produces a liquor which may be oxidised at double the present rate on a percolating filter.

This recommendation was adopted, and Mr. Whitehead, the engineer to the board, is now building a plant.

The Birmingham experience envisages a much wider application of the activated sludge process than has been contemplated hitherto. It deals with a tank effluent from which sludge has been partially eliminated and reduced in volume to about 10 parts per 100,000 by passing crude sewage through ordinary sedimentation tanks, thus minimising to the fullest extent one of the greatest drawbacks to the bio-aeration process as it was originally put forward —viz., de-watering and disposing of great volumes of spent or exhausted activated sludge. It gets rid of foul odours and enables a bacteria bed to oxidise twice as much sewage. (In the discussion A. S. Parsons, of Reading, said that he doubted whether activated sludge plants were much cheaper than percolating filters, or were as delicate as now supposed; at one time it was thought that percolating filters were delicate.)

TANKS AND SLUDGE DISPOSAL

As regards the popularity of various other methods of sludge disposal, reference may be made to the result of the questionnaire already referred to. Returns were received from ninety-nine sewage works, and although they did not all confine themselves to a single method, the following statement is helpful:

Lagooning.....	was employed at	57	places.
Land	"	15	"
Lagoons and land.....	"	5	"
Pressing	"	12	"
Pressing and lagoons..	"	6	"
Digestion and air drying	"	1	"

The expression lagooning is not very definite, and it probably includes trenching into land in some instances; but, whatever it includes, it has taken the place of pressing so common some years ago, and although it is more representative of English practice to-day than any other single method of treatment, it is far from ideal, especially as regards the smell nuisance.

In this respect digestion and subsequent air drying possess merits which have not been sufficiently recognized. The well-known Imhoff or two-story tank ensures digestion in proportion to its efficiency but it has not found favour here, although its prototype, Dr. Travis' hydrolitic tank, originated in England. Nevertheless, the Imhoff tank produces a non-smelling sludge, and is worthy of more notice than it has received. The principle involved is followed by three local authorities in England—Birmingham, Bath and Chorley—where complete digestion in "single-story" tanks secures a reduction of one-third of the volume of sludge, elimination of fat, conservation of nitrogen and the all but entire removal of foetid odour.

Activated sludge in its fresh state contains about 5 per cent of nitrogen, but unlike digested sludge, it does not part at all readily with its moisture, which is 99 per cent of its volume. Many unsuccessful attempts have been made to separate solid from liquid. In a tropical climate the combination may be no disadvantage, but in a climate like ours it is, and it points to the desirability of activating only that volume of sludge that is absolutely required to effect efficient flocculation instead of burdening the plant, and subsequently the drying process, with more solid matter than is absolutely necessary.

Recent Legal Decisions

HIGHWAY CONTRACTOR NOT REQUIRED TO GRAVEL PREVIOUS CONTRACTOR'S WORK

A highway contract requiring the contractor to protect the work done under the contract in case of stoppages did not require him to spread gravel on 3.84 miles of subbase put down by a previous contractor. People v. Greylock Const. Co., 128 Misc. 61, 217 N. Y. Supp. 868.

HAULING SAND FOR SUBCONTRACTOR COVERED BY GOVERNMENT BOND

Where material and labor were furnished to be used and were used in the construction of public works for the United States, whether the persons furnishing them were called materialmen or contractors in an action on the contractor's bond required by Act of Congress of Feb. 24, 1905 (Comp. St. Section 6923) was held immaterial. The statute was held broad enough to cover materials and labor furnished to a subcontractor, and to cover the hire of boats and labor used in hauling sand for the construction of a weir for the government. Utah Const. Co. v. United States, C.C.A., 9th circuit, 15 Fed. (2nd) 21.

BREACH OF CONTRACT BY NONPAYMENT

Evidence of nonpayment during the progress of excavation work as required by the contract and of notification to suspend work in violation of the contract was held to sustain a claim of breach of the entire contract for nonpayment where the nonpayment was the cause of the contractor's cessation of work. Drainage Dist. No. 7 of Poinsett County, Ark. v. Sternberg, C.C.A., 8th circuit, 15 Fed. (2nd) 41.

MEASUREMENT OF ROAD CONSTRUCTION CONTRACT—CHANGE OF ENGINEERS DURING WORK

There is no reason why engineers should not be changed in the course of a contract, if this is not done to secure a fraudulent or unfair advantage, and the final estimate is conclusive as to all the work, superseding prior monthly estimates, although made by a previous engineer, where the contract so provides. Inexperience of the engineer would not invalidate the final estimate.

But the result must be reached by the methods of measurement required by the contract, and a final estimate, based on a compromise between two alternative methods thereby prescribed, is not made in accordance with the contract.

Where more than a year elapsed before the remeasurement of a road construction contract, it was held that no subtraction should be made for shrinkage under a contract provision that 90 per cent in fresh embankment should be measured as equal to 100 per cent, in "original position," as this entire shrinkage would occur within the year.

The contractor was held entitled to compensation for filling stump holes under the road, where his contract contemplated compensation for all dirt put into the road embankment. Road Improvement Dist. No. 5 of Crittenden County, Ark. v. Roach, C.C.A., 8th circuit, 18 Fed. (2nd) 755.

COLLECTION OF SPECIAL ASSESSMENTS

Municipal corporations possess no inherent power to levy assessments for local improvements. Their only authority to do so is to be found in the statutes. In collecting money to pay for special improvements where there is no liability against the corporation, the corporation authorities do not act as its representatives, but as special agents or instrumentalities to accomplish a public end. A holder of special assessment bonds cannot impose liability therefor on the general taxpayers on the ground of negligence of officers of the municipality. Moore v. City of Nampa, C.C.A., 9th circuit, 18 Fed. (2nd) 860.

USES TO WHICH PARK LANDS MAY BE PUT

A taxpayer may maintain an action to prevent the misuse of park property by putting it to a use which does not serve a purpose for which park property may be lawfully used.

Refreshment booths are a convenience to persons frequenting the park and have been approved as serving a park purpose. It is immaterial that they will incidentally be patronized by passers-by on the street, or that the greater part of their patronage will come from that source, unless it should appear that the purpose of serving park uses was a mere pretense. Williams v. New York, 222 N. Y. Supp. 163.

The New York Appellate Division, First Department, holds, Tobin v. Hennessy, 222 N. Y. Supp. 484, that a system of operating park lands which permits individuals to secure continuous tenure of plots of ground for years at a time, upon which substantial structures are erected and permanently maintained, is a diversion of the park lands from a park use and is not authorized by section 610 Greater New York Charter or the ordinances adopted pursuant thereto. The city should not, however, be restrained from issuing camping permits under such conditions as will preserve the park character of these lands, and their general and impartial allocation to as many citizens as can fairly be permitted to enjoy them.

CONTRACTORS' WARRANTS ISSUED ON LESS THAN PAR VALUE BASIS

The decision of the Arkansas Supreme Court that a county court may issue to a competitive bidder in payment of the contract price warrants on less than a cash par value basis even when the bid before it states that fact, so long as there was no fraud or collusion between the bidders based on this consideration, and no colusion between the county court and the contractor to give him the contract at an increased price because the value of the county scrip was less than par, is held to be binding on the federal court. Here the proof was that the bid, or contract, itself made no reference to any depreciated value in the warrants, but that the commissioners and the court clearly understood that the contractor was estimating the warrants as worth 60 cents on the dollar and that his bid price (payable in warrants) was so based. With this knowledge, the com-

missioners accepted the bid and the court approved it. Franklin County, Ark. v. Harriman Nat. Bank, C.C.A., 8th circuit, 19 Fed. (2nd) 182.

MUNICIPALITY HELD NOT LIABLE TO MATERIALMAN FOR FAILURE TO REQUIRE STATUTORY CONTRACTOR'S BOND

The Circuit Court of Appeals, Eighth Circuit, holds, E I. Du Pont De Nemours & Co. v. City of Glenwood Springs, 19 Fed. (2nd) 225, that a city is not liable to one furnishing explosives to a construction company under contract with the city for an unpaid balance because the city failed to require the statutory bond on letting the contract and to retain funds due the contractor, in the absence of an agreement in the contract to retain funds to pay labor and materialmen, or of a statute requiring the city to pay the materialman's claim or act as a trustee for its benefit. The court said: "A rule of law which would require a municipal corporation to pay for material furnished to a person to whom it lets a contract, because of the failure of its officers to require a sufficient bond, or because of their failure to exercise the privilege of withholding from the contractor payment of money due him until claims for material are paid, would be against sound public policy. As was said in the case of Merwin v. Chicago, 45 Ill. 133, 'A municipal corporation is a part of the government. Its powers are held as a trust for the common good. It should be permitted to act only with reference to that object, and should not be subjected to duties, liabilities, or expenditures merely to promote private interest or private convenience.'"

CONTRIBUTORY NEGLIGENCE OF PEDESTRIAN IN STEPPING ON EXPOSED GAS PIPE IN STREET

In an action for personal injuries it appeared that the plaintiff stepped on a three-inch natural gas pipe laid between the paved part of the sidewalk and the street curbing, and at this point projecting above the ground and nearly parallel with the pavement. The gas pipe yielding to her weight caused plaintiff to slip and the toe of her shoe caught under the paving stone in front of her, so that she fell on the sidewalk. There was no crossing at this point, but it was used as a short cut by pedestrians. The negligence charged was that the gas pipe was permitted to be loose or unsupported at the place where plaintiff stepped on it. It was held, Buchanan v. Grove City Borough, 86 Pa. Superior Ct. 178, that plaintiff was guilty of contributory negligence and could not recover. If she chose to test the stability of the pipe, she did so at her own risk. She could have avoided it by going to one side or stepping over it, and could have seen that it was not a stepping stone for approach to the sidewalk. "A pedestrian may pass over streets at whatever place he chooses and is not limited to established crossings, but in so doing he must exercise ordinary care under the circumstances."

VALIDITY OF BILLBOARD ORDINANCE

The New York Appellate Division holds, People v. Wolf, 220 N. Y. Supp. 656, that a village ordinance under New York Village Law, Section 90, subd. 26, prohibiting billboards and advertising signs except signs advertising realty measuring not more than 4x4 feet is valid as to a signboard advertising realty 9x12 feet. Young, J., concurred on the ground that the ordinance was reasonable enough as applied to the present case, although he was of opinion it was discriminatory in so far as it prohibits all signs except those advertising realty.

AUTHORITY TO OPERATE GARBAGE DISPOSAL PLANT

New York Special Term, Westchester County, holds, Nicoll v. President & Trustees of Ossining, 220 N. Y. Supp. 345, that Village Law section 89, subd. 25, does not authorize a village to operate a garbage disposal plant when by so doing it materially interferes with the enjoyment of property, or annoys and interferes with the neighbors living in the vicinity of the plant.

COUNTY'S DUTY AS TO SAFETY OF HIGHWAY UNDER REPAIR

A county is not an insurer of the safety of those who have occasion to use a county highway in process of repair. It is only required to use such care as, under the circumstances, is reasonable and ordinary in its inspection of the highway and in the execution of such repairs as it finds necessary or undertakes to make. It is required to use reasonable and ordinary care to maintain the highways reasonably safe for the traveler using them while in the exercise of reasonable and ordinary care.

Evidence of subsequent repairs made or precaution taken after an accident or the infliction of an injury is not admissible to prove antecedent negligence. Evidence that a red lantern had been placed at the end of a pile of dumped gravel, with which motorcyclists had collided, the day after the accident was held inadmissible in an action for injuries. Fricker v. Lancaster County, Nebraska Supreme Court, 213 N. W. 826.

ERRONEOUS METHOD OF ESTIMATING DAMAGES FOR BREACH OF CONTRACT FOR EMBANKMENT WORK

The South Carolina Supreme Court held, Walker v. Quinn, 133 S. E. 444, that to adopt the pit measurement in estimating the damages for breach of contract for embankment work in connection with highways results in an erroneous amount, not only to the extent of the natural disparity between the contents of the embankment and the cubical calculation of the contents of the cavity, but to the extent also of the 10 per cent. upon embankment measurement allowed by the contract, at least where no data exist by which an estimate can be made of the disparity.

MATERIALMAN'S RIGHT TO INDEMNITY UNDER PUBLIC WORKS BOND

The Georgia Supreme Court held, American Surety Co. of New York v. Bibbs County, 134 S. E. 100, that where a materialman improperly brought suit in his own name against a bonding company as surety, and it appeared that under the terms of the bond no indemnity was provided on behalf of the materialman, an amendment was not allowable, under the State statutes, making the action proceed in the county's name for the use and benefit of the materialman.

NEWS OF THE SOCIETIES

October 3—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS: Annual meeting at Denver, Colo.

Oct. 5-8—CALIFORNIA SECTION, AM. WATER WORKS ASS'N. Meeting at San Jose.

Oct. 10-12—SOUTH WEST WATER WORKS ASS'N. Meeting at Hot Springs Ark.

Oct. 12-14—AM. SOCIETY OF CIVIL ENGINEERS. Fall meeting at Columbus, O.

Oct. 13-15—MISSOURI CONFERENCE ON WATER PURIFICATION. Third annual meeting at Sedalia, Mo.

Oct. 17—CONFERENCE OF STATE SANITARY ENGINEERS. Annual meeting at Hotel Gibson, Cincinnati, O.

Oct. 17-21—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention at Columbus, O.

Nov. 7-9—NORTH CAROLINA SECTION, AMERICAN WATER WORKS ASSOCIATION. Meeting at Durham, N. C.

Nov. 14-18—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Thirty-third annual convention at Dallas, Tex.

Nov. 28-Dec. 2—ASPHALT PAVING CONFERENCE. Sixth annual conference at Atlanta, Ga.

Dec. 1-2—HIGHWAY RESEARCH BOARD, NAT'L. RESEARCH COUNCIL. Annual meeting at Washington, D. C.

Dec. 7-8—NATIONAL RIVERS AND HARBORS CONGRESS. Annual convention at Washington, D. C.

Jan. 9-10—INTERNATIONAL ASSOCIATION OF STREET SANITATION OFFICIALS. Annual convention at Detroit, Mich.

Jan. 9-14—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention and road show at Cleveland, O.

Jan. 19-21—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting at New York City.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS

The thirty-third annual convention of this society will be held November 14th to 17th at Dallas, Texas, with headquarters at the Baker Hotel.

Monday morning and afternoon will be devoted to registration and meetings of committees. The convention will open in the evening with an address of welcome and the President's address, followed by reports of the Executive Committee, Secretary, Treasurer, and Finance Committee. Selection of committees on Nominations and on Resolutions and other new business will finish the evening program. There will be no evening meetings on the other days.

Tuesday morning, 9 to 12, there will be reading and discussion of papers on City Planning and on Municipal Legislation and Finance. In the afternoon there will be reports of Specifications Committees and of representatives in other organizations.

Wednesday morning sessions will be devoted to papers and discussions on Street Paving and Street Design; and to election of officers, adoption of resolutions, and other new business.

Thursday morning there will be papers and discussions on Water Works and on Street Lighting.

Thursday afternoon will be the closing session, with papers on Sewerage, Sanitation, Garbage, Disposal, Street Maintenance, Street Cleaning, Snow Removal, and miscellaneous papers.

There will be visits to the plant of the Trinity Portland Cement Co. from noon to 2:15 Tuesday, the company providing luncheon. On Wednesday afternoon and evening the Ft. Worth delegates will be hosts of a trip to that city, the delegates and guests going by special cars, with luncheon en route; then being taken by automobile to the sewage treatment plant, the water works reservoir, filtration and pumping plant, with a barbecue at Lake Worth.

A golf tournament will be played off during the week.

On Tuesday evening there will be a social gathering, with dancing and bridge, at the hotel. On Thursday evening, a banquet at the hotel.

For the ladies there will also be a bridge luncheon Tuesday noon and a theatre party Thursday afternoon.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The Fall meeting of the A. S. C. E. will be held at Columbus, O., October 12th to 15th, with headquarters at the Neil House. The meeting will be called to order at 10 Wednesday morning and following opening addresses, the technical session will begin at 10:30. Another technical session will begin at 2:30 P. M. There will be technical sessions on Thursday morning and afternoon, and an illustrated address Thursday evening. All day Friday will be given to an excursion to the water purification works, dams and reservoir of the Columbus water system, and Saturday morning to a visit to Ohio State University.

The papers to be read and discussed Wednesday follow: "The O'Shaughnessy Dam and Reservoir," by John H. Gregory, C. B. Hoover and C. B. Cornell; with discussion by W. H. Dittoe and Daniel W. Mead. "Water Purification and Softening of the Columbus Water Supply," by Charles P. Hoover; with discussion by F. H. Waring, Geo. W. Fuller and Robert Spurs Weston.

A Symposium on Flood Control, including an introduction by Edgar Jadwin; "Resume of the Mississippi River Problem," by C. McD. Townsend; "Rainfall Characteristics of the Mississippi Drainage Basin," by H. C. Frankenfield; "Run-off Characteristics of the Mississippi Drainage Basin," by N. C. Grover; illustrated address portraying the Mississippi flood of 1927, by George R. Spaulding; address on "Mississippi River Flood Control," by Secretary Dwight F. Davis.

On Thursday the Structural, Waterways, Highway, and Sanitary Engineering Divisions will meet separately. The first will hear and discuss papers on "The Observed Effect of Climatic Changes Upon a Multiple-Span Concrete Arch and Their Influence Upon Design," by W. M. Wilson, discussed by G. E. Beggs and Hardy Cross; "Problems Concerning Elastic Stability in Structural Engineering," by S. Timoshenko, discussed by H. M. Westergaard and William Hovgaard; and "The Design of Tall Buildings to Resist Wind," by Albert W. Ross and Clyde T. Morris, discussed by F. E. Schmitt.

Before the Waterways Division will be presented "The Work of the Mississippi River Commission," by C. W. Kutz; "Forest Cover as a Factor in Flood Control," by E. F. McCarthy; "Reservoirs," by William Kelly and Arthur E. Morgan; "Levees," by John F. Coleman; "Spillways as a Means of Flood Control," by William P. Wooten; "Improvement of Navigation in Relation to Flood Control," by S. C. Godfrey; "The Flood Problem of New Orleans," by Marcel Garsaud; "Auxiliary Channels or Bypasses as a Means of Flood Control," by M. G. Barnes; "Relief Outlets and Bypasses as Features of the Flood Control Works on the Sacramento River," by C. E. Grunsky; "Reclamation as Affecting Flood Control," by Elwood Mead; "Power as Affecting Flood Control," by F. W. Scheidenhelm; and "Drainage as Affecting Flood Control," by S. M. Woodward. These will be discussed by Frank B. Maltby, Morris Knowles, Charles H. Paul, F. G. Jonah and C. S. Jarvis.

Thursday afternoon the Highway Division will listen to papers on "Practical Utility of Highway Transport Surveys," by George F. Schlesinger; discussed by R. H. Simpson and W. A. Van Duzer; and "The Engineer's Part in Making the Highways Safe," by A. H. Hinkle, discussed by G. C. Dillman and E. W. James.

At the same time, before the Sanitary Engineering Division, E. G. Bradbury will read a paper "Sewer and Water Construction under the County Sewer District Law of Ohio and the Assessment of Cost in Proportion to Benefits"; and William D. Hatfield and Samuel A. Greeley, one on "The Sewage Disposal Works of Decatur, Ill."

PERSONALS

B. H. Davis, a leading concrete bridge engineer, died August 17 at Saranac Lake, N. Y., aged 44 years.

Elson T. Killam, formerly assistant superintendent, New Bedford, Mass., water board, is now assistant engineer on the staff of Frank A. Barbour, consulting engineer.

James A. Childs, senior sanitary engineer of the Minnesota State Board of Health, has been granted two years' leave of absence to permit him to serve as chief engineer of the Metropolitan Drainage Commission of St. Paul and Minneapolis.

Frank C. Wight, editor of Engineering News-Record, died Sept. 18, aged 45 years. He graduated from Cornell as an engineer in 1904 and in 1906 joined the staff of Engineering News, remaining with it until his death.

Charles McMillan, professor of civil engineering at Princeton University from 1875 until 1914, when he retired, died September 19 aged 86 years.

George F. Schleisinger, for some years superintendent of public works of Ohio, has been reappointed for the balance of this year, when a new law goes into effect changing the position.

C. H. Rust, for many years city engineer of Toronto, Ont., and later of Victoria, B. C., died Sept. 22nd.

BOOK REVIEWS

Residential Sewage Treatment Plants. By Lindon J. Murphy. 24 pp. Ill. Published by the Engineering Extension Department, Iowa State College, Ames, Ia. An interesting booklet giving the essential details of house plumbing, and describing grease traps, cesspools, small septic tanks and secondary treatment. Capacity, construction, and operation of septic tanks are considered. Subsurface irrigation, trickling, filters, and intermittent sand filters are secondary treatment methods described briefly.

The Sewage Treatment Tank. 29 pp. Ill. Florida State Board of Health. This is a good presentation of the principles, design, location and methods of construction of the small septic tank for homes. It does not cover tanks for industrial, municipal or community uses. For the most part it discusses clearly and succinctly the more important of the numerous questions that continually come to the engineer or sanitarian in the health field. Too much space is given to construction of home-made tanks. In nine cases out of ten, it is cheaper, in the end, and far more satisfactory to buy a high grade ready-made tank than it is to build one or have some jack-of-all-trades construct one according to his own fanciful designs. The use of ready made tanks saves health workers a good deal of time and worry and should be recommended by them.

Proceedings of the Louisiana Engineering Society. Bi-monthly publication of the Louisiana Engineering Society, New Orleans, La.

TRADE PUBLICATIONS

History of the Explosives Industry in America. By A. P. Van Gelder and Hugo Schlatter, Institute of Makers of Explosives.

This history shows the important part that explosives have played in the economic growth and development of this country. It enumerates some of the important large projects mentioned, including the Croton Aqueduct, which required 7 million pounds of explosives, the Jerome Park reservoir, which used 2½ million pounds, the Catskill Aqueduct, the Los Angeles and Chicago supplies and many others. As it says, "With the advent of modern explosives and mining methods there came a great revival in the building of aqueducts."

Adjustments of Gurley Levels. 16 pp. Ill. W. & L. E. Gurley, Troy, N. Y. Another of the series of instruction booklets on the adjustment, care, and use of Gurley instruments. These instructions are in the briefest possible form, and are in 3¾x6¾ size, punched for loose-leaft note books.

Planning Municipal Drainage for Today and Tomorrow. 24 pp. Ill. The Armco Culvert Mfrs. Ass'n. This bulletin discusses the ways in which Armco Corrugated Iron Pipe meets the requirements of rapid construction, strength, and economy.

Keystone Blast Hole Drills.. 4th Edition. 60 pp. Ill.; The Keystone Driller Co., Beaver Falls, Pa.

While essentially a catalog which describes and lists the Keystone line of portable well drilling machines, tools and supplies, and equipment for blast hole drilling, this publication provides some extremely interesting information on the development of well drilling. Probably the first deep well was that begun in 1832, near Paris, and sunk to a depth of 1,780 feet after ten years of labor; another near Passy, France, sunk in only six years to a depth of 1,913 feet, produced 5½ million gallons per day. The story of the evolution of the spring-pole driller into the modern well drilling machine is of both interest and value.

Considerable space is devoted to detailed information in regard to blast-hole drilling, including costs of drilling, methods of spacing and loading, the amount of explosive needed, handling of explosives, etc. Subaqueous blast-hole drilling is also discussed, but rather briefly.

Keystone Drills. 18th Edition, 106 pp. Ill. The Keystone Driller Co., Beaver Falls, Pa.

This general catalog lists and describes the Keystone line of portable well-drilling machines, tools and supplies, and equipment for all classes of drilling work. As introductory matter it covers in an interesting manner the development of well-drilling methods from the spring pole of 50 years ago to the modern fast-working well-sinking machines, the principles of which have contributed so materially to the production of oil and other necessities of modern life.

INDUSTRIAL NOTES

WELDING CONFERENCE

A conference embracing all phases of the welding industry is to be held at the University of Minnesota on October 20-22, 1927, according to plans prepared by Prof. S. C. Shipley, acting head of the Mechanical Engineering Department of the College of Engineering. A large part of the conference will be devoted to papers on practical subjects by practical users, and to round table discussions.

REPUBLIC MOTOR TRUCK CO. PURCHASES LINN MANUFACTURNIG CORPORATION

The Republic Motor Truck Co., Inc., Alma, Mich., has purchased the entire capital stock of the Linn Manufacturing Corporation of Morris, N. Y., tractor manufacturers, and is now sole owner of that company, including its plant, equipment, good will and exclusive selling rights. The operations of the Linn Manufacturing Corporation will be continued at Morris, N. Y., as a division of the Republic Motor Truck Co., Inc. The present personnel will also be maintained.

NEW YORK OFFICE FOR EARLE GEAR AND MACHINE CO.

The Earle Gear and Machine Co., with main office and plant at 4707 Stenton Ave., Philadelphia, Pa., have opened a New York office at 95 Liberty St., with C. N. Walsh and G. E. Barrett in charge. All matters relating to cut gears, operating machinery for moveable bridges, lock gates and dredges and Lea-Simplex cold metal saws may be referred to the New York office. An office is also maintained at 110 State St., Boston, Mass., in charge of W. H. Allen.

W. A. RIDDELL CO. PURCHASES HADFIELD-PENFIELD STEEL CO.

W. A. Riddell Co., Bucyrus, O., has purchased the Hadfield-Penfield Steel Co., the American Clay Machinery Co. and the Era Steel Co. and will continue and develop these companies.

CLIMAX BRANCHES MOVE.

The Chicago office of the Climax Engineering Co. has been removed to 1608 Harris Trust Bldg. The office was previously located in the same building, but on a different floor.

The J. L. Latture Equipment Company of Portland, Oregon, representatives in Oregon, Washington and Idaho of the Climax Engineering Co., Clinton, Iowa, are located at 312 to 314 E. Madison Street, Portland, Oregon.

TRACYFIERS NOW MADE IN PITTSBURGH.

The Andrews-Bradshaw Company of Pittsburgh, Pa., which has for some time past owned a controlling interest in the Tracy Engineering Company of San Francisco, has recently acquired full ownership of that company's entire plant. The Tracyfier organization has been augmented by the transfer of George Ahlworth, former plant superintendent of the Tracy Engineering Company, and Carl Petersen, chief draftsman, who join the Andrews-Bradshaw Company forces.

CHAIN BELT CO. CHANGES

Charles G. Olson, formerly of the main office of the Chain Belt Company, Milwaukee, has been transferred to the Detroit office. Mr. Olson was connected with the sales department for several years before his transfer. He will look after the Rex chain and engineering business of the company in Detroit territory with headquarters at the company's office at 8855 Woodward Avenue.

Luther H. Bosnian has been appointed superintendent of the Park Street plant of the Chain Belt Company, Milwaukee, Mr. Bosnian is a graduate of the Sheffield Scientific School, Yale University,

(*Continued on page* 44)

New Appliances

Describing New Machinery, Apparatus, Mate rials and Methods and Recent Interesting Installations

"The contractor, for self-preservation, must increase his productivity by eliminating the waste attendant upon his operations. Competition is not likely in the near future to be any less severe than it is today. The man who is poorly prepared to meet it is going to have a hard struggle to keep his head above water, and eventually he will go under. He who is unable or unwilling to prepare himself for this competition would better, if he can, ally himself with a stronger organization or go out of the contracting business.

"The age we are living in is a strenuous one. Men are growing up who have had greater advantages than the older ones of us, and they are going to succeed where their forebears failed. They are not going to be satisfied with the results of a few years ago. They are going out after the last penny and they are going to get it through the use of highly trained men and up-to-the-minute equipment. You cannot afford to bother with anything but the best. Anything else will bankrupt you as it is bankrupting others."

This is the opinion expressed a few weeks ago by T. Warren Allen, Chief of the Division of Control, Bureau of Public Roads. Briefly, he says that a contractor can not succeed today unless he uses the best up-to-the-minute equipment. The aim of this department of *Public Works* is to help contractors learn what is the best up-to-the-minute equipment for their particular jobs.

NEW TYPE OF THEW PULL SHOVEL

The Thew Shovel Co., Lorain, O., has put on the market a new type of pull shovel or trench hoe which, it is claimed, offers some unusual advantages for sewer and excavating work. It is called a "Back Digger" and is stated to be very efficient in cellar and trenching work.

The primary difference between this and previous types, is in the control of the dipper, which can be tilted by the operator to any angle desired, at any stage of the digging or dumping operation, and held in position or changed by the operator at will.

Instead of spilling the dipper load through the entire arc of the digging arm, as with the stationary dipper type, this tilting dipper permits the operator to hold his load until he has spotted his dipper exactly where wanted, over a wagon, truck or spoil pile, after which the dipper can be instantly dumped. When dumping close, much time is saved because it is unnecessary to swing the dipper to the extreme limit each time to empty it completely. When sticky material clings to the dipper the operator can shake the dipper to dislodge the unspilled remainder.

The control of the dipper tooth angle at any position of the digging arm also provides digging advantages not possible with the stationary type of dipper. In basement digging this arrangement permits trimming the sides and bottom the excavation, or making a straight vertical cut at the start of a trench or at the finish. The tilting dipper is also an aid in back filling. The dipper can be pulled to the edge of the trench in a horizontal position pushing the dirt before it and can then be tilted to empty the dipper into the trench. The ability to hold the dipper in any position desired while backfilling, permits cleaning up the entire spoil pile without gouging into the solid ground beneath it.

This equipment can be attached easily and quickly to any Lorain 75 or Lorain 60 shovel.

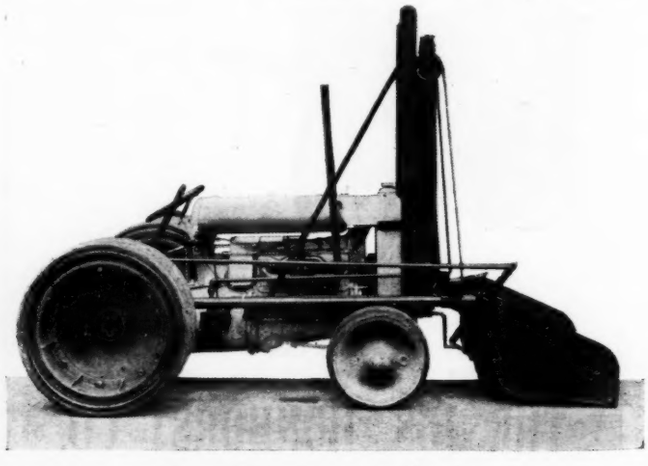
THEW PULL SHOVEL OR TRENCH HOE

HUBER MOTOR ROLLER

The Huber Manufacturing Co., Marion, O., manufactures the Huber Motor Roller, which, it is claimed, will do more and better work with less trouble and lower operating cost, than any other roller. The engine is 4-cylinder, valve-in-the head construction, 4¾-inch bore and 6½-inch strike, and has a pressure oiling system. The roller is provided with two speeds forward and two reverse, providing a range of speed from 1 to 4 miles per hour. The weight is 10 to 12 tons. A pneumatic scarifier, which is a unit of the roller, is mounted underneath the roller deck. The depth of scarifier cut is regulated by drag shoes at either end of the tooth bar, which are easily adjusted to give the desired depth of penetration. Among the other advantages claimed are easy starting, no noise, no vibration, sufficient fuel and water capacity for 3 days, and great economy of operation.

NORTH HYDRAULIC DIGGER

The W. M. Blair Mfg. Co., Chicago, Ill., manufactures the North Hydraulic Digger, which is mounted on the Fordson tractor or the Fordson equipped with Full Crawler. This digger operates on the hydraulic principle, and is



THE NORTH HYDRAULIC DIGGER

equipped with a ⅓-yard bucket for loose material work, and a ¼-yard bucket for use with clay or solidly packed materials. It digs, hauls, backfills, grades and handles materials. It is claimed to handle 90 yards a day under average conditions, and will operate at a very low yard rate.

It is simple to operate, as there are but two control levers, and no brakes or clutches, and is of very rugged construction.

AUTOMATIC CONE CHECK VALVE.

The Automatic Cone Valve Co., Chicago, Ill., manufactures the automatic Cone check valve, which, when used with centrifugal pumps, prevents reversal of the pump and eliminates rams, surges and water-hammer. The Cone valve performs the function of a hydraulically

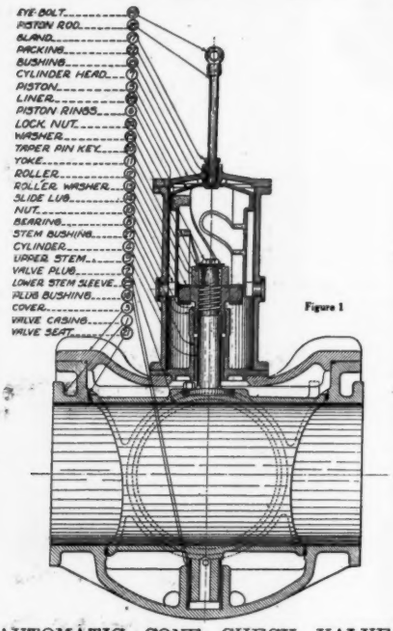


Figure 1

AUTOMATIC CONE CHECK VALVE

operated gate valve, and the control mechanism adds to the valve the additional function of making it also a check valve. The valve can be manually operated also; it can be closed completely while the pump is running, or throttled to any position desired, so that the amount of flow can be regulated to maintain any desired pressure in the distribution system, but at no time is the automatic closing of the valve interfered with. The plug is always rigidly held in its bearings and, whether closed, throttled or open, does not rattle.

The valve was designed by David D. Goldberg.

SMALL ELECTRIC MELTING POT

The General Electric Co., Schenectady, N. Y., has introduced a new electric melting pot for melting solder, lead, babbitt, tin, etc., which has a capacity of from 27 to 40 pounds, according to the metal to be melted. This pot may be operated on either 110 or 220-volt alternating or direct current circuits and is made in two ratings, 750 and 1,000 watts. It is the smallest size of the G. E., RP form E line. It consists of a durable sheet steel cylindrical casing ten inches deep and nine inches in diameter, in which is supported a cast iron crucible four inches deep and six inches in diameter, inside. The space between the crucible is efficiently insulated with a compact heat insulator.

The new pot is designed for melting led, babbitt, tin, solder and similar alloys or metals, except spelter or zinc, at temperatures not exceeding 950 deg F. Detailed capacities follow: for 50-50 solder, 30 pounds; for lead, 40 pounds; for babbitt, 37 pounds, and for tin, 27 pounds. The approximate shipping weight is 50 pounds.

NEW JACK FOR FINISHING MACHINE

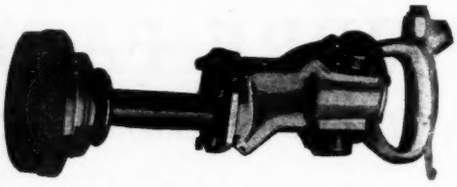
The Lakewood Engineering Co, Cleveland, Ohio, has developed a special jack for mounting the transportation wheels on finishing machines. This jack enables the contractor quickly and easily to remove or install the transportation wheels on the job, an operation that formerly took considerable time.

NEW CONCRETE SURFACING TOOL

Ingersoll-Rand Company, New York City, has developed a portable concrete surfacing machine, operated by compressed air, which quickly and easily smothes concrete surfaces and removes form marks. It is claimed to save much time and labor on this work and give a far better job than hand rubbing. It will surface either green or old concrete.

The machine is equipped with a ring-shaped grinding wheel which utilizes the flat face of the wheel, the grinding wheel being held in a wheel head by one side with the other side open for grinding. To keep the grinding wheel from tipping on edge and cutting into the work, a flexible joint is provided in the wheel head. This flexible coupling is a special feature of the tool provided to insure the true action of the wheel on the surface being finished. The wheels are easily renewed when worn down by use.

A three-cylinder type of air motor is used in the machine and is of a balanced type, smooth running and free from breakdowns. All wearing parts, including the cylinders, are renewable, and the cost of upkeep is thus reduced to a minimum. The tool weighs only 13 pounds and is easily handled in any position.



CONCRETE SURFACING TOOL

When provided with special grinding wheels the tool, known as Size 6G, may be used for finishing and polishing monumental and building stone.

LA PLANT-CHOATE SNOW PLOWS

The La Plant-Choate Manufacturing Co., Cedar Rapids, Ia., manufactures a complete line of snow plows, including a V-type plow for motor trucks and busses, a V-type plow for use with "Caterpillar" tractors, a reversible blade plow for "Caterpillar" tractors a reversible plow for motor trucks and busses, a trip blade plow for all makes of motor trucks, and a side-walk plow for use with 2-ton tractors. The method of mounting the plow in all tractor mounts is claimed to be especially advantageous. It consists of mounting the plow at the center of the tractor. The frame of the plow is of heavy H-beam construction extending all the way around the tractor. This frame is mounted on the tractor by means of a sub-axle, which rests on the tractor frame near the center. This method reduces the strain on the plow frame. The major part of the weight of the plow is in the V at the front. Three large mushroom shoes keep the plow at the correct working distance from the ground, whether the nose of the tractor is titlted up or down.

LA PLANT-CHOATE SNOW PLOW

FRINK "SNO-PLOWS"

Carl Frink, Clayton, N. Y., manufactures the Frink Sno-Plows. These have complete inside control, protecting the operator from weather conditions. It is claimed that, because of better balance and easier control, Frink Sno-Plows can be operated at a higher rate of speed, thus covering more road, in proportion to the size of the plow and the power and speed of the motor unit. Frink plows are built of steel throughout, except for two small gears and chilled cast shoes; the frame is of mild steel, hot riveted and bolted; in case of accident, any blacksmith can make repairs. It is stated that, while designed to operate in a depth of snow equal to the height of the moldboard at the nose, much deeper snow can be handled, while the plow will neither push sidewise nor wedge.

The Frink Sno-Plow is attachable to any truck chassis; but no truck smaller than a 2-ton should be used for any except for the No. 1 plow. Plows are built in sizes from 6 to 7 1-2 feet blade width, 2 to 3 feet nose height, and moldboard spread from 100 to 124 inches. Weights are from 900 to 1800 pounds, and the operating speeds are 5 to 35 miles per hour.

HARRINGTON-SEABERG TRAFFIC SIGNALS.

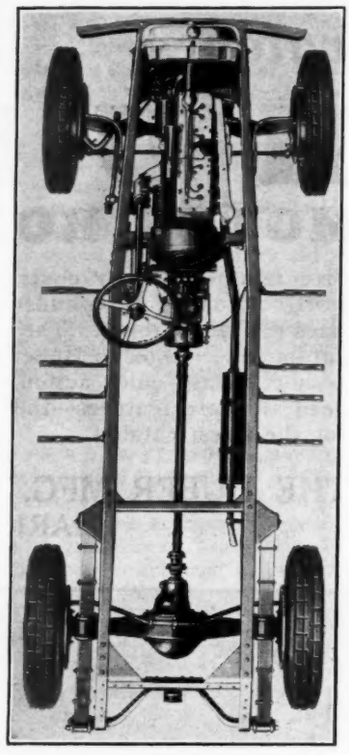
The Harrington-Seaberg Co., Moline, Ill., manufactures a wide variety of traffic signal control equipment. The Simplex traffic timer, which is enclosed in a weather-proof aluminum cabinet, is capable of cycle adjustments from 25 to 150 seconds, while the controls for each street are adjustable within a range of 25 per cent to 75 per cent of the complete cycle. It is especially designed for carefree operation. It is furnished with or without hand control.

H-S traffic signal lights are made of aluminum, saving weight, and preventing corrosion, and making installation easier than with cast iron. The signals are furnished in either vertical or horizontal style; the light compartment is dustproof, and reflectors are of silvered glass.

GRAHAM BROS. MOTOR TRUCKS.

Graham Bros., Detroit, Mich., the truck division of Dodge Bros., Inc., has introduced a complete new line of trucks, the feature of which is a fast and powerful six-cylinder two-ton chassis, available in three styles. Three important features of the new truck are the engine, which is equipped with a 7-bearing crankshaft and provides ample power and speed for fast travel and pull; a four-speed, heavy-duty transmission, which contributes greatly to the trucks' ability to perform under the most difficult road conditions; and hydraulic 4-wheel brakes. The brakes are automatically equalized, largely eliminating the necessity of making adjustments.

Various axle gear ratios are available, so that the purchaser may choose that ratio most suitable for the work which he plans for the truck.

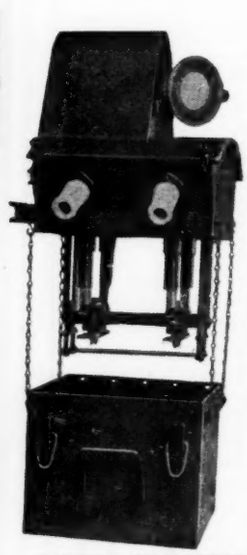


CHASSIS OF GRAHAM BROS. NEW TWO-TON TRUCK

SAUTER ELECTRIC TIME SWITCHES.

The R. W. Cramer Co., New York, handles the Sauter electric time switches, which are adapted for turning on and off electric circuits of all kinds, such as for street and traffic lighting and control, pumping and ventilating machinery, and aircraft beacons. Sauter switches eliminate the human element to the extent of doing away with manual winding and weekly setting; they may be left alone for two or three months. If they are used to control illumination on a full-night or half-night lighting schedule, the clocks may be equipped with the appropriate type of Sauter astronomic dial, the operations of the time switch then following automatically the changes in schedule. If operations are to be omitted on Sunday, or if week-end hours are different, a special Sunday cut-out dial is available. There are in stock in New York dials to care for the local dawn and dusk time of any locality in this country. Schedules can be arranged to start or stop illumination at any time before or after sunset or sunrise.

H. S. TRAFFIC SIGNAL



SAUTER ELECTRIC TIME SWITCH

INDUSTRIAL NOTES

(*Continued from page* 38)

and has been connected with the Chain Belt Company's production department for the past eight years. Previous to this he was with the Westinghouse Electric and Manufacturing Company.

BUTLER VACUUM STREET SWEEPER FOR NEW YORK.

New York City has recently put into operation a fleet of Butler Vacuum street sweepers manufactured by the Butler Mfg. Co., Cleveland, O. Three machines were purchased three years ago, and as a result of their satisfactory work, more units have been added. The machines work duriug the day, some of them in the down-town sections. No water is required to make them dustless in operation, the principle of operation being similar to that of the vacuum cleaner.

BUCYRUS AND ERIE CONSOLIDATE

A merger of the Bucyrus Company, South Milwaukee, Wis., and the Erie Steam Shovel Company, of Erie, Pa., has been arranged, and a third company, to be known as the Bucyrus-Erie Company is being organized to take over the assets of the present corporations.

The Bucyrus Company was originally organized at Bucyrus, O., about forty-seven years ago and was reorganized at South Milwaukee in 1911. Its specialty has been heavy machinery, of which it has been a leading manufacturer in the United States, with large sales abroad. The Erie Steam Shovel Company was formerly the Ball Engine Works. It turned to the steam shovel business in 1914. Its specialty has been small power shovels. The new company will have a complete line of machinery.

WORTHINGTON PUMP & MACHINERY CORPORATION.

The transfer of certain types of Diesel engine construction from the recently closed Blake and Knowles plant at Cambridge to the newly enlarged Snow works in Buffalo has been accomplished as a step in the policy of concentrating facilities for increased efficiency in economical operation. For the last two years the Snow plant has been expanding and modernizing to prepare for this transfer, and is now completely renovated. The best of the Cambridge plant equipment has been moved in and installed in space newly provided. To

meet the demand for additional power, a large new power plant has been built, and the storage and shipping facilities enlarged.

MISSOURI OFFICE OF LINCOLN ELECTRIC MOVES

The Missouri District Office, Lincoln Electric Co., has been moved to 1003 Davidson Bldg., Kansas City. Robert Notrest is in charge of this and the St. Louis office. A branch office has been established at 220 Nicholas Building, Toledo, O., with A. H. Homrighaus in charge.

CLEVELAND DISTRIBUTER FOR WOOD HOISTS.

The American Coach and Body Co., James Holan, Cleveland, O., is distributor for Cleveland for the Wood Hydraulic Hoist and Body Co., Detroit, Mich.

YOUNG HEADS NEW RADIATOR COMPANY.

F. M. Young, formerly vice-president and general manager of the Racine Radiator Company, has organized and been elected president of the Young Radiator Company of Racine, Wis., which will manufacture heavy-duty radiators, including bus, truck, tractor, power unit and various industrial types.

J. J. Hill has been appointed sales manager of the company.

NEW TRACKSON DISTRIBUTORS.

The Trackson Company Milwaukee, Wis., announces the appointment of two new distributors for its Trackson Full-Crawlers, as follows: William Ford Company, 15,841 Second Blvd., Highland Park, Mich., for the Detroit territory; and the T. W. Meiklejohn Company, Fond du Lac, Wis., for the Milwaukee territory. These companies will carry both the Standard Model F Trackson Full-Crawler and the heavy-duty Model D Trackson, as well as repair parts for both models.

UNIVERSAL CRANE MOTOR TRUCK CRAWLER

In order to permit contractors, state and county highway officials and others interested, to see the Universal Crane Motor Truck Crawler in operation, the Universal Crane Co., Cleveland, O., has sent a unit under its own power from New York to Cleveland. At the various cities actual job demonstrations were arranged, including excavation, trenching, barge and car unloading and steel erecting. The mobility of the unit was also demonstrated, showing its ability to operate at 16 miles an hour on eight rubber-tired wheels, and to operate as a crawler under exceedingly difficult conditions.

UNIVERSAL CRANE ON DEMONSTRATION TOUR

THEW SHOVEL CO. SALES ORGANIZATION.

The Thew Shovel Co., Loraine O., has announced the addition of five men to their sales organization, as a result of the success of the Lorain 75-A and 60-A shovels, cranes, draglines, and backfillers. James S. Griffin, who has had experience as a railroad contractor and in the sale of shovels and contractors' equipment, will cover New Mexico, Colorado, and Wyoming, with headquarters at Denver. E. L. Sparks, who has been engaged in construction and sales work, recently having been with the Ohio Locomotive Crane Co. and the Williams Bucket Co., will be in charge of sales in California. J. L. Trout, a man of wide experience in the operation and sale of power shovels, has been assigned to Pennsylvania, Ohio, and West Virginia. M. B. Garber has been appointed promotion engineer. He has had a long experience in crushed stone, gravel and other material handling work. P. A. McMillon has been attached to the Thew Chicago office as sales engineer.

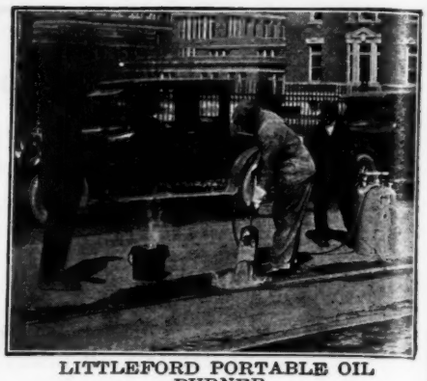
DOWFLAKE ON MICHIGAN ROADS

As stated in our May issue, the State Highway Department of Michigan has developed a method of using calcium chloride mixed with gravel in constructing roads. This is being used very extensively and during the first eight months of this year the state used 18,000 tons of calcium chloride for approximately 3000 miles of state owned graveled roads. Probably an equal amount has been used on the various county roads in the state. The Dow Company shipped three train loads of this material to northern Michigan on one order in June of this year.

PORTABLE OIL BURNERS.

The accompanying illustration shows a torch type oil burner being used to dry holes before patching in one of Cincinnati's principal streets. This type of heater was recently placed on the market by Littleford Bros., Cincinnati, O.

Portable oil burners are of much value in many fields of work, including concrete heating in winter construction work, heating mortar in cold weather, thawing frozen piles of sand, gravel, and



LITTLEFORD PORTABLE OIL BURNER

stone heating asphalt in melting kettles, drying concrete for waterproofing, thawing frozen ground for excavation, and melting ice and snow on street manhole covers.

GALION IRON WORKS BRANCHES

The office and warehouse of the Kansas City branch, Galion Iron Works & Mfg. Co., is now located at 1205-1207 Woodsweather Avenue, Kansas City, Mo., in a building owned by the company. R. L. Boston is branch manager.

The Galion Iron Works & Mfg. Co. branch at Orlando, Fla., D. B. Findley, manager, has moved to 1107-09 Virginia Drive, Orlando, Fla.

The company will construct at Galion, O., a new fireproof steel and brick building, 90x340 feet, which will be used for assembling Galion Motor Graders, Adjustable Leaning Wheel E-Z Lift Graders, and Straight Wheel Graders.

SPEEDER MACHINERY CORPORATION.

Glen D. Cooper, electrical engineer, has been appointed assistant sales manager of the Speeder Machinery Corp., Cedar Rapids, Ia. Mr. Cooper, who has had a wide experience in the electrical industry, will have charge of the organization and development of the industrial field, acting as assistant to T. M. Deal, sales manager.

SALES CONFERENCE

The Speeder Machinery Corporation, Cedar Rapids, Ia., manufacturer of Speeder shovels, cranes, draglines and pull shovels, recently held a sales conference under the direction of T. M. Deal, sales manager, with the entire sales force in attendance. Announcements of additions to both sales and service departments were made.

EXHIBITION OF ADVERTISING SPECIALTIES

The Department of Commerce and Industry, Osaka Municipal Office, Osaka, Japan, will hold an exhibition of advertising specialties, and asks that American manufacturers send samples for demonstration. The particular types of materials to be sent are not specified; samples will be returned without expense, if desired. Only material with advertising on it is desired. M. Vasheiba is director of the Department of Commerce and Industry.